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Is the Arc Lamp Doomed?

The announcement by the leading manufacturer of tungsten-filament incandescent lamps that a series lamp has been developed with a specific consumption of 0.5 watt per candle and a life of 1000 hours naturally prompts the question "Is the arc lamp doomed?" The tungsten lamp has already displaced the ordinary inclosed arc lamp in many sections of the country on the score of better efficiency and service, not to mention lower maintenance, and now that the tungsten lamp itself has been improved by the application of an inert gas under pressure so that its specific consumption is cut in half, it becomes a serious competitor of the flaming-arc lamp. For the present at least, the lamp can only be made in large sizes with thick filaments for series service, and inasmuch as street-lighting contracts are usually based on a flat rate per lamp per annum, the substitution of the improved tungsten lamp for the inclosed arc lamp in public street lighting will doubtless follow quickly after the commercial introduction of the lamp. That it will supplant the flaming-arc lamp is problematical and that it will long dominate the public lighting field is also questionable. There is too much money invested in the arc-lamp industry to permit the contest to go by default, and developments, particularly in the flaming-arc field, ought to follow very quickly.

Governmental Indorsement of C. G. S.

Hereafter the diamond carat, instead of being a nondescript unit that only a few esoteric persons understand, will be a fifth of the international gram which civilized people understand. It is to be hoped that this much-needed reform may speedily be extended to other departments of the United States government service. We are weary of being the laughing-stock of Europe for maintaining, in conjunction with Great Britain, the existing jumble of weights and measures that costs so much of intellectual labor to keep up. It is high time that the United States, which so early adopted a simple decimal currency, should also adopt the simple international decimal metric system.

The Fight for Patent Reform

On former occasions we have advocated the appointment of a broadly organized, liberal-minded patent commission to make a searching investigation of the patent system of the United States. In another column we present the last set of resolutions adopted by the Inventors' Guild, and in particular we would draw attention to the remarks attributed to President Woodrow Wilson that there is no hospitality for invention nowadays and that therefore mankind has been deprived of many comforts and conveniences, as well as the opportunity of buying at lower prices. There is said to be no serious probability of action during the present extra session of Congress upon the patent bills before it, yet this is certainly an opportune time to ask Congress for a real commission, with full powers, to commence the great task which the friends of true reform have insistently demanded be undertaken. The passage of an act authorizing the commission is a detail, but it ought to be attended to without delay, so that the selection of members of the commission may be taken up with that careful deliberation it needs.

White Salmon River Development

The article descriptive of the hydroelectric station of the Northwestern Electric Company of Portland, Ore., appearing in this issue is another indication of the rapidity with which one hydroelectric development has followed another in that section of the country in the past few years. The station in question is interesting as a type, rather than for any exceptional feature which it possesses, although the wood-stave-pipe line is said to be unparalleled in size among conduits of its kind. Cradles resting on heavy mud sills running the length of the line were employed to support the pipe, because when filled with water the static load is approximately 4 tons per foot of length and this is greater than the weight per foot of length of the heaviest locomotive. Hence the need of an excellent foundation. Like most hydroelectric plants, the system will be insured against complete shut-down by the installation of an auxiliary steam station. This will be located in Portland at the end of the transmission line and will be used to advantage during cold weather by carrying a heating load. The rainfall in the Pacific Northwest is heaviest in winter, as is also the demand for electricity, owing to the length of the nights, so that good service ought to obtain with both the hydraulic and steam stations in operation. In the late summer, when the water is not so plentiful, the steam station can be used to help out the the hydraulic station at a time when the heating load is not very great. Advantage was taken of natural conditions in the construction of the head-works when preparing and pouring the concrete, showing that the engineers were also economists; for almost all the work was done by gravity. Evidently the promoters of the enterprise had abundant faith in the future of the district in which it is located, for it would seem that with the numerous electric developments which have been started in the Pacific Northwest within the past two years the market for electrical energy would be flooded; but apparently new territory and new industries are opening up fast enough to absorb it.

Transmission Span Design

The design of a long span is always interesting, and especially if the stresses on the end towers are included. We print this week an article by Mr. K. Nogami giving the detailed computations for a span of 1180 ft. at Hiroshima, Japan, across the famed straits of Ondo. The actual breadth of the straits at the crossing is only about 500 ft., but to erect towers on the banks would mean raising them to a height of nearly 150 ft. in order to provide the required clearance of 130 ft. for vessels beneath the span. Consequently, the towers were erected farther apart on more elevated ground.

Hiroshima is fortunate in having no sleet problem to consider, a circumstance which greatly adds to the available factor of safety. Use is to be made of stranded steel wires nearly ½ in. in diameter. The annual temperature range is given as from 10 deg. to 100 deg. Fahr. According to the data given, the sag will range from 9 ft. to 23 ft., varying with the temperature. The details for the stability of the higher tower are of special interest. It is to be hoped that after the lines have been placed in position data will be presented indicating the actual behavior of the stresses, the maximum stress observed, and a comparison between the observed results and the design.

The Visibility of Light Sources

An important paper on the visibility of point sources of light by Messrs. Paterson and Duddington, of the National Physical Laboratory, has recently been published in England. It bears directly on some of the fundamental matters with respect to the photometry of light sources, particularly emphasizing certain matters which have been rather generally misunderstood. The authors deal particularly with point sources of light, touching therefore such important practical matters as the visibility of signal lamps at long distances and the examination of distant light sources by extinction instruments. The point source was assumed for the purpose of the investigation to be one subtending about thirty seconds of arc at the distance view, in other words, an angle considerably smaller than that which corresponds to the ordinary resolving power of the eye. To anticipate a bit, however, it was found that the area of the aperture observed could be increased considerably beyond the nominal angle representing the resolving power of the eye without material change in the results. It is of course known that conditions of visibility are materially altered when large areas are observed, but the critical area is considerably larger than is generally supposed. The observations were made with small illuminated apertures of various sizes, the actual light from which was varied either by sector disk or by absorption wedges until they matched the suitable comparison source.

The first conspicuous fact brought to the surface in the investigation was that the visibility of the small source of light, or what amounts to the same thing, its apparent brilliancy, is proportional to the total candle-power of the source and is independent of its intrinsic brightness. This law was found to hold for sources subtending an apparent angle of nearly 2.0 deg., although most of the areas involved were considerably smaller. This means that after a source is at so considerable a distance that it corresponds to a point as here described its intrinsic brilliancy, in its effect on the eye, is a matter of no consequence whatever. This fact is thoroughly reinforced by experience in street lighting, in which one cannot distinguish between the light from a bare arc and that through a diffusing globe when the distance from the illuminant is sufficiently great. It is only at relatively short distances that the serious phenomena of glare enter. And, second, it was found that the visibility of the source varied actually, as it should in theory, as the inverse square of the distance. In other words, for distance sources the only thing that counts is the distance and the total candle-power, and one can photometer by an extinction instrument, or one allowing point comparisons, such distant sources utterly irrespective of what their intrinsic brilliancy may be. This accounts for the sometimes wonderfully consistent results which can be obtained by comparing two light sources by the simplest kind of extinction photometer.

These fundamental facts were pointed out some twenty years ago by Charpentier as a result of his own careful experiments, but the present thorough study should leave the whole matter beyond the possibility of dispute and should make the facts known to a far greater public than was reached by the French investigator, whose admirable work seems to have been half forgotten. Some extremely interesting tests were made on the effect of color in the point sources and of the results of using spectacles in observing. It was found that the effect of color on the visibility of the points was marked, particularly when spectacles were used, the differences being apparently due to the diffusion of the point image on the retina owing to the chromatic aberrations of the eye or the variation of focus produced by the spectacles. It is to be noted in this particular that when the pupil is widened in very dim light, as is usually the case in such experiments, the correction required for sharpest definition is changed, the ordinary eye becoming somewhat short-sighted in very weak light, so that persons requiring considerable correction of vision by spectacles may be handicapped in seeing distant signals or attempting to photometer point sources.

A New Notion in Ventilation

The haze of honest doubt that has surrounded the ozone machine in some quarters should be largely dispelled by the results of the ventilation tests reported before the Buffalo meeting of the Society of Heating and Ventilating Engineers by trained physiological and psychological experts, who point out, as reported in an earlier issue, that an ozonizer performed important service in keeping sweet and wholesome for three hours at a time schoolroom air which was being simply recirculated without the introduction of outside oxygen. These experiments place on a scientific basis the fact long suspected that the usual empirical allowance for ventilation has no relation whatsoever to the actual physiological needs of the human system. And they prove with finality that even a roomful of school children can work at full efficiency and comfort, breathing the same air three hours or more at a time, if that air is

properly "renewed" and deodorized. The psychological tests were continued over a period long enough to prove that no after-effects were to be felt. The efficacy of the ozonizer was also demonstrated on the occasions when its operation was interrupted for a half hour or so, the resulting "stuffiness" of the air in the room making itself at once apparent to teacher and pupils. And if we have now proved that instead of unnecessarily burning tons of coal to heat large cubic sections of cold outdoors which are simply passed through our buildings and discharged back to the winter breezes, it is only necessary to consume a negligible number of watt-hours to keep fresh and sweet, air that has already once been brought to the temperature of comfort, it looks as if the scouted ozone machine were really one of the greatest little engines of conservation of this prodigal age.

Cheap Line Construction

In organizing a small energy-transmission plant one meets now and then conditions which call for a special study of cheap—sometimes even temporary—line construction. The present tendency—sound and generally to be encouraged—is toward thoroughly good construction, the erection, in fact, of a line which is put up to stay, not at all regardless of expense, but without the necessity for extreme economy. Nevertheless, there are classes of instances in which economy is of paramount importance, and it takes no small amount of finesse to know just how to keep down expense without imparing efficiency for the purpose in hand. For instance, a contractor may desire to extend a line for a few score rods or even a few miles in order to obtain energy from an existing line, or it may be necessary to put in a line to meet the needs of a temporary customer or to deliver energy for only two or three months per year for pumping or furnishing light to a summer or winter colony. In work of this sort one cannot afford to expend much money on construction without robbing the proposition of all its profit. Hence one has to make a special study of those points at which economy can be secured most safely.

In electrical energy transmission there are three directions in which one can work with comparative safety by departing a little from ordinary routine practice. The first of these is the matter of the height of poles. Transmission lines are usually on 35-ft. or 40-ft. poles, and the construction of the pole line is based on the theory that every pole and every wire must have an ample factor of safety above the worst conceivable combination of sleet and wind. Now, when two or three relatively light wires are to be used for a temporary or intermittent supply there is no possible need of resorting to main-line construction. It is astonishing how much energy can be transmitted over three wires even as small as No. 6. The poles may advantageously be only 30 ft. or even 25 ft. in clear country, the 30-ft. size being in some ways advantageous. For such work a somewhat large and stubby pole, which would not ordinarily be picked out for permanent line construction, can be efficiently utilized. One short cross-arm and a top insulator furnish ample accommodation for the wires at such voltages as are commonly used.

The second point at which economy may be gained is in increasing the average spacing. A line of stocky 30-ft. poles may well be spaced from 150 ft. to 200 ft. in clear country with positive advantage from every point of view. Ordinary lines are built on the precedent of old telephone and telegraph practice, where many cross-arms had to be carried on a single pole. To continue this practice where only three small wires are to be erected represents simply a foolish waste of money. It has taken a good many years to wean electrical line contractors away from telephone and telegraph precedents, but often on the Pacific Coast, and now and then elsewhere, really sensible spacing is to be found.

The third matter in economy is that of voltage, which is closely allied with the two things already discussed. The tendency is to work short and temporary lines at too low a voltage when the lines are of fair length. One often sees a 2300-volt branch line through a perfectly clear country where 10,000 or 12,000 volts might be used just as well with very slight added expense for insulators. When one uses the higher voltage there is no need for heavy wires and a correspondingly heavy structure to support them. In fact, it is often a question whether a good steel wire construction is not worth while where the amount of energy to be transmitted is not considerable; it has been tried now and then with excellent results. A 10,000-volt line with poles spaced a couple of hundred feet and cheap steel wires giving the necessary strength will deliver a good deal of energy without an impracticable drop and at a cost much below that of so-called standard construction.

Fans for Invalids

Comfort and efficiency are promoted by the use of the electric fan during ordinary summer weather; but in the case of the sick tossing on restless beds of fever or pain the electric fan becomes a veritable necessity during such extremely warm weather as has been experienced in many localities this summer. The breeze from an electric fan is a distinct alleviation of the distress of invalids when the thermometer stands at 90 or above, and it is almost cruel to fail to provide it. This fact is often realized too late where houses are not wired for electricity although electrical facilities might be had. Sometimes it is possible to make a temporary connection with a more fortunate neighbor's house through lamp-cord extending from window to window. Sometimes even this makeshift cannot be resorted to, and it is of real importance that householders should be prepared for this emergency. Electric-service companies in some cities have offered to install electric fans on a doctor's prescription, without charge, where the patient was unable to pay and where electric service was available. Probably all hospitals are equipped with the soothing hot-weather ministration of the noiseless whirring blades; but there are tens of thousands of well-to-do householders who would hardly fail to provide a source of electricity in their homes if they fully realized the great comfort of the fan in cases of illness. It is a humane privilege as well as good commercial practice for the central-station company to make clear this often-neglected opportunity.

The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

Wisconsin Water-Power Bill Signed

Governor Francis E. McGovern of Wisconsin on Monday affixed his signature to the water-power bill, which in substance provides for the complete public control of water-power by the State Railroad Commission. No material alterations were made to the bill in the Assembly so that the measure reported in our issue of July 26 remains virtually as published.

Municipal Railways Proposed for Philadelphia

Construction by the city of Philadelphia, Pa., of a subway line on Broad Street and of elevated lines to outlying sections was recommended by City Transit Director Taylor in a voluminous report made public on July 31. Director Taylor, who has been engaged for more than a year in an exhaustive study of the rapid transit problems of Philadelphia, estimates that the total cost of the improvements recommended would be $57,587,000. The city would pay $34,682,000 and the companies leasing the lines $22,896,000.

Exhibition of Electrical Appliances at Glasgow

The Corporation of Glasgow, Scotland, has made definite arrangements for the exhibition of electrical appliances which will be held in the city from Oct. 23 to Nov. 15 to bring before the public generally the advantages of electricity for many purposes. There will be shown appliances for domestic heating, stoves of all kinds, cooking and laundry appliances, water heaters, circulators and geysers, appliances for the generation, transmission and utilization of electricity, elevators and hoists, fans and other ventilating apparatus, mechanism for preventing the emission of dust and dirt from chimneys, show-window lighting and illustrations of the use of electricity for cinematograph purposes. Two exhibitions of this kind have been held in London and one in Manchester within the past ten years, but this will be the first exhibition which has been arranged in Glasgow for the display of purely electrical appliances.

Single-Phase System Adopted by Norfolk & Western

At the recommendaton of Messrs. Gibbs & Hill, consulting engineers, New York, the Norfolk & Western Railway Company has adopted the single-phase system for the electrification of the Elkhorn Grade-Bluefield section of its main line. The intention is to use energy having a frequency of 25 cycles and a potential of 11,000 volts at the trolley. The electricity will be supplied from a 27,000-kw generating station to be erected by the company at Bluestón, W. Va., and for transmission purposes the potential will be raised to 33,000 volts and the transmission line will be carried mainly on the catenary bridges. Feeding points will be established at suitable locations along the line sufficiently close to minimize the voltage drop and inductive disturbances. In view of the fact that freight trains only will be handled, the locomotives, of which there will be twenty-four, are to be equipped with motors of the induction type and the control and connections are to be arranged to give running speeds of approximately 7, 14 and 28 miles an hour respectively. Special attention is being given to the queston of regeneration and electric braking at grades, which would decrease the wear and tear on train equipment, and also, under favorable conditions, tend to reduce the demand on the generating system. The engineers concluded to recommend the single-phase system after an exhaustive analysis of the various systems now in use in this country and abroad. A careful study was also made of the local conditions involved, and comparisons were made of the capital and operating costs based on operating data and manufacturers' bids for equipment.

Double-Unit Turbo-Alternators for New York Subway

The Interborough Rapid Transit Company has awarded to the Westinghouse Machine Company the contract for three 30,000-kw steam turbo-generator units for installation in the Seventy-fourth Street station to assist in supplying energy for operaing the enlarged New York subway. Each unit will consist of a high-pressure and a low-pressure element, each element comprising an independent steam turbine driving a synchronous alternator. The high-pressure and low-pressure turbine of each unit will be goverened simultaneously in order that the load on the unit may be divided properly between the two elements.

Convention of Edison Illuminating Company Sales Managers

The fourth annual convention of sales managers connected with the larger Edison companies was held at Association Island, Henderson Harbor, N. Y., Aug. 4, 5 and 6. Following a general discussion on rates and isolated plants, papers were read and discussed on the following topics: "Organization of an Unused Meter Bureau," by Mr. J. F. Becker, of the United Electric Light & Power Company, New York; "Baltimore Practice of Following Up Unused Meters," by Mr. R. F. Bonsall, of the Consolidated Gas, Electric Light & Power Company, Baltimore; "Wiring Existing Buildings," by Mr. C. E. Robertson, of the Consolidated Gas, Electric Light & Power Company, Baltimore; "Co-operation of Other Departments with Salesmen," by Miss S. M. Sheridan, of the Detroit Edison Company; "Illuminating Engineering," by Mr. J. D. Israel, of the Philadelphia Electric Company; "White-Way Lighting," by Mr. F. D. Beardsley, of the Union Electric Light & Power Company, St. Louis; "Limitation of the Electric Vehicle," by Mr. C. M. Marsh, of the Potomac Electric Power Company, Washington, D. C.; "Suggestions for Building Up an Electric Vehicle Load," by Mr. Harvey Robinson, of the New York Edison Company; "Work of Power Engineering Bureau," by Mr. C. H. Stevens, of the Edison Electric Illuminating Company of Brooklyn; "Unity Load-Factor Cooking Apparatus," by Mr. Mathias Turner, of the Cleveland Electric Illuminating Company; "Notes on Cooking by Electricity and Other Methods," by Mr. L. R. Wallis, of the Edison Electric Illuminating Company of Boston; "Selling Electrical Appliances," by Mr. F. D. Pembleton

of the Public Service Electric Company, Newark, N. J. There was a very lively discussion on all of the papers, that on Miss Sheridan's paper being exceptionally good. On Wednesday afternoon the rest of the electrical men on the island defeated the sales managers in a game of baseball.

The meeting this year was under the chairmanship of Mr. R. F. Hale, of the Boston Edison company. The committee elected for next year is composed of the following: Mr. E. W. Lloyd, of the Commonwealth Edison Company of Chicago, chairman, and Messrs. A. A. Pope, of the New York Edison Company, and J. D. Israel, of the Philadelphia Electric Company. The sessions of the sales managers are not open to the public and very little of what transpires is printed, although some of the papers later find their way into publicity through other conventions. Those attending the convention were Messrs. R. F. Hale, W. G. Stetson and L. R. Wallis, of Boston; E. W. Lloyd and J. G. Learned, of Chicago; Douglass Burnett, C. E. Robertson and R. F. Bonsal, of Baltimore; F. E. Beardsley, of St. Louis; Parker H. Kemble, of Cincinnati; H. K. Mohr, R. B. Ely and J. Meyer, of Philadelphia; C. A. Littlefield, A. A. Pope, W. Gould, H. Robinson, J. Becker, A. F. Berry and D. V. Smith, of New York; F. E. Pembleton, of Newark; M. Turner and R. H. Wright, of Cleveland; Miss S. M. Sheridan, Miss F. Norwell, Messrs. R. F. Duncan and E. Crosby, of Detroit; Messrs C. M. Marsh and J. C. McLoughlin, of Washington; T. I. Jones and C. H. Stevens, of Brooklyn.

Pittsburgh Convention I. E. S.

On page 168 of our issue dated July 26 there was given a preliminary list of papers to be presented at the convention of the Illuminating Engineering Society to be held in Pittsburgh, Pa., from Sept. 22 to 26. The committee on papers has arranged for the following additional papers: "Some Theoretical Considerations of Light Production," by Mr. W. A. Darrah, of Pittsburgh; "Conduction Losses in Series Tungsten Lamps," by Mr. Armine, of Harrison, N. J.; "Church Lighting," by Mr. R. B. Ely, of Philadelphia; "Factory Lighting," by Messrs. Flexner and Dicker, of Chicago; "Modern Practice in Street-Railway Illumination," by Mr. S. G. Hibben, of Pittsburgh; "Hospital Lighting," by Mr. M. J. Kilmer, of New York; "The Use of Nitrogen at Low Pressures in Tungsten Lamps," by Mr. G. M. J. McKay, of Schenectady; "The Illuminating Engineering Laboratory of the General Electric Company," by Mr. S. L. E. Rose, of Schenectady, N. Y., and "Window Lighting," by Mr. H. B. Wheeler, of Chicago.

It is also expected that the following papers will be presented: "Store Lighting," by Messrs. Clarence L. Law and A. L. Powell, of New York (this paper is to be a continuation of the subject discussed by these authors at the Niagara Falls convention last year); "Some Commercial Aspects of Gas Lighting," by Messrs. Witte and Philbrick; "The Efficiency of the Eye Under Different Systems of Illumination," by Dr. C. E. Ferree, of Bryn Mawr, Pa.; "Physiological Aspects of Illumination," by Dr. F. Park Lewis, of Buffalo; "Errors of Photometric Measurements" and "The Commercial Fields Opened by Recent Developments in Lamp Manufacture," by representatives of the engineering department of the National Electric Lamp Association, Cleveland, and "Spectacular Lighting During the Knights Templar Conclave in Denver," by Mr. G. E. Williamson, of Denver. A lecture on "The Developments of the Alternating-Current Luminous-Arc Lamp" will be delivered by Dr. C. P. Steinmetz, of Schenectady.

During the week beginning Sept. 22 there will be held in Pittsburgh a meeting of the American Mine Safety Association, devoted, as its name indicates, to the promotion of safety in mines. During the sessions of this association the Bureau of Mines, located in Pittsburgh, will conduct several interesting experiments in mine explosions. These experiments will afford an excellent opportunity for those interested in the illumination of mines to investigate this phase of the subject under actual operating conditions.

Philadelphia Convention of N. E. L. A.

At a meeting of the executive committee of the National Electric Light Association at its headquarters in New York on July 23 President J. B. McCall stated that invitations had been received from New York City, Milwaukee, Atlantic City, Asheville and New Orleans, each suggesting that the next convention be held in that city. At the request of Mr. C. L. Edgar, of the Edison Electric Illuminating Company of Boston, President McCall expressed his own wish to have the next convention in Philadelphia, stating that some 2300 hotel rooms would be available. He also gave details as to other needed convention facilities, whereupon it was unanimously voted to hold the next convention at Philadelphia. There has been no convention of the association held in that city since 1887.

L. A. Osborne on Manufacturers and the Society for Electrical Development

Certain striking statements made by the vice-president of the Westinghouse Electric & Manufacturing Company concerning the aims of the Society for Electrical Development are given in the following paragraphs.

It may appear unusual to some that the electrical manufacturers should have so readily agreed to make liberal contributions to the funds of the Society for Electrical Development. In fact, the readiness of the manufacturer to support the movement has led some to suspect that it was planned primarily in his interests. Reflection, however, will show that the attitude of the manufacturer is merely co-operative in the broadest sense of the word and is an evidence of his appreciation that that which is truly co-operative is, in the last analysis, profitable.

Speaking as a manufacturer, we expect that our return will accrue after the central station, jobbers, dealers and contractors have begun to enjoy a measure of return as a result of the activities of the society.

It goes without saying that the success of the movement will largely depend upon the spontaneity with which the different branches of the industry respond. There is a psychological moment when a movement of this character should be launched, and that is that moment when all are of the same mind as to its importance. Let that moment pass without definite action and there is danger of a weakening of that sustaining power of co-operation which is needed. If the different branches of the industry are willing in spirit but lacking in financial help, those intrusted with the responsibility of making the work of the society successful will not be encouraged to proceed with the confidence and enthusiasm which is so necessary in an undertaking of this kind. Neither should they be handicapped by the necessity of seeking members, but they should be permitted to exercise their talents in the legitimate activities of the society, which are broadly to impress upon the public at large the desirability of "doing it electrically."

The ideals of the society are ambitious but attainable and when carried out should, within a reasonable time, bring measurable returns to all branches of the industry.

The campaign planned by the society to awaken an interest in things electrical should very early have an appreciable effect upon the trade of central stations, jobbers, dealers and contractors.

If, through co-operative advertising, the architect, the contractor and the builder might be educated to such a point that in all dwellings, regardless of cost, outlets for the use of electrical appliances should be plentifully provided, the

business of the dealer in electrical appliances would be increased as well as the work of the electrical contractor, and it goes without saying that there would be a corresponding increase in demand for electrical energy through which the central station would profit. The manufacturer secures his reward through an increased demand for his manufactured products, and, in the broader aspect of the case, in the ultimate increase in generating and distributing apparatus.

The general education of the people in the use of electrical vehicles brings its reward to the manufacturer of the vehicle, as well as to the makers of the motor and battery which propel it, and continuously to the central station providing energy for its operation.

When real-estate dealers and investors are educated by co-operative advertising to make capital of electrically lighted and electrically equipped homes, then naturally an increase in business is bound to result therefrom, and as the ideas of men enlarge the volume of increase will multiply rapidly. It is to our interest to educate the public to the feeling that what yesterday was merely an electrical luxury is to-day a necessity.

When we can familiarize men in the professions—dentists, surgeons, doctors, etc.—and in the multiplicity of trades, even the smallest and least important, with the value of doing things electrically and make such men understand about things electrical, great will be the profit to the electrical business, and we shall have realized, in part at least, one of the ambitions of the society.

Especially should this movement appeal to central stations, even more than to the manufacturer, for each customer of the central station is a continuing customer and a source of continued profit and revenue, whereas to the manufacturer each sale is a transaction complete in itself.

Altogether a movement having such useful and beneficial aims should receive the generous support of all in the industry, at least until such time as the soundness of the idea can be tested, and particularly of those branches of the industry which are obviously most likely to receive the most immediate returns from the movement.

Meeting of Executive Committee of the N. E. L. A.

The first meeting of the new executive committee of the National Electric Light Association was held at the association's headquarters in New York on July 23. Executive appointments for the ensuing year were made and confirmed as follows: Mr. T. C. Martin, secretary; Mr. A. S. Sewall, assistant to the secretary; Miss Harriet Billings, assistant secretary; Mr. E. W. Burdette, counsel; Mr. W. H. Blood, Jr., insurance expert; Miss Gladys Burkhalter, assistant secretary of the Commercial Section. The resignation of Mr. C. A. Stone, of Boston, as member of the executive committee, was presented and accepted with regret, and Mr. H. G. Bradlee, of the Stone & Webster Corporation, was elected to succeed him. President McCall presented a very full list of the new chairmen of the regular committees and of the membership of each. A new committee on educational relationships was created, with Mr. J. F. Gilchrist as chairman, and also a new committee on safety, with Mr. Martin J. Insull as chairman.

The membership now totals 12,676, and is apportioned as follows: Class A, 1104; Class B, 10,430; Class C, 55; Class D, 243, and Class E, 844. Of the 518 new members elected, forty were Class A and eleven Class D.

Colonel Street, the newly elected president of the Canadian Electrical Association, gave an interesting account of the situation in Canada and asked that the Canadian body should have full representation on all committees so that it could co-operate thoroughly in all association work. Mr. T. I. Jones, of Brooklyn, chairman of the Commercial Section, brought up the question of the continuance of the old "Electrical Solicitor's Handbook," which has not been revised for about two years, and it was voted to turn this publication over to the Commercial Section for such revision and use as it saw fit to make.

Secretary T. C. Martin stated that the *Bulletin* of the National Electric Light Association had had second-class mail privileges accorded to it by the post office authorities, so that a saving of approximately $3,000 a year would be effected. Mr. E. W. Lloyd, of Chicago, having consented to serve again as chairman of the research committee, it was voted to continue the publication of *Rate Research* under the direction of the committee. Mr. W. C. L. Elgin, of Philadelphia, as a member of the resuscitation commission, was requested to look into the matter of a motion-picture film illustrating the adopted prone-pressure method of resuscitation from electric shock.

Resolution of Inventors' Guild on Patent Reform

Under recent date the Inventors' Guild circulated a set of resolutions urging the co-operation of chambers of commerce and similar bodies throughout the country in securing the appointment of a patent commission to study the whole subject and report. The resolutions follow:

"Whereas the fact that certain trusts and large corporate manufacturers have been accused of using patents improperly, both offensively and defensively, to aid them in effectually stifling competition, has resulted in the introduction of bills before Congress intended to regulate such abuses by making radical changes in the United States patent system;

"Whereas the hearings on the Oldfield bill (H. R. 23,417) in the spring of 1912 demonstrated that there were marked differences of individual opinion among inventors, legislators, manufacturers and patent lawyers as to the changes in our patent system which would be desirable to subserve the best interests of the United States;

"Whereas there is now pending before the Sixty-third Congress in the House of Representatives a bill (H. R. 1700) introduced by Mr. Oldfield, Representative from Arkansas, which provides for radical changes in the United States patent system fraught with the most serious consequences to the people of the United States, and especially to independent and competitive manufacturers and inventors;

"Whereas the intention of the United States Constitution to stimulate the publication of valuable inventive thought by granting and securing an exclusive right to the inventor who first publishes his invention through the agency of a patent of the United States seems to have been lost sight of in said Oldfield bill (H. R. 1700), and said proposed law would tend to reduce instead of tending to increase the creation and publication of inventions valuable to the people of the United States;

"Whereas President Wilson has recently given warning to the people of the United States of the importance of these questions in the following language:

"'Do you know, have you had occasion to learn, that there is no hospitality for invention nowadays? . . .

"'I am not saying that all invention has been stopped by the growth of trusts, but I think it is perfectly clear that invention in many fields has been discouraged, that inventors have been prevented from reaping the full fruits of their ingenuity and industry, and that mankind has been deprived of many comforts and conveniences, as well as the opportunity of buying at lower prices. . . .

"'One of the reforms waiting to be undertaken is a revision of our patent laws.'*

"Whereas the Inventors' Guild, composed exclusively of

*The "New Freedom," in *World's Work*, 1913.

independent inventors, petitioned President Taft on Nov. 24, 1911, for his aid in securing the appointment of a patents commission to investigate and report upon the subject of possible improvement of the patent system for the benefit of the United States;

"Whereas the various chambers of commerce in the principal cities of the United States are fairly representative of all the interests concerned in this matter, including manufacturers, inventors and the people generally;

"Be it resolved, That the Inventors' Guild does hereby invite each of the chambers of commerce and similar representative organizations throughout the United States to aid the Guild in its efforts to secure the appointment of a patents commission by urging the Congress of the United States that it provide for such a commission made up of unbiased, independent, non-partisan men of such national standing as will command the respect and confidence of the whole country, chosen from different walks of life and serving without pay. Said commission to hold public hearings and otherwise, as may appear to it best, to make a thorough and careful study of the American patent situation, and to prepare and submit a comprehensive report and recommendations to Congress for such changes as may, as the result of its study, appear to it expedient, whether in the Patent Office, in the method of court procedure or in the organic patent law, and to submit recommendations as to the legislation it would propose for effecting such changes. And the Guild further requests the several chambers of commerce to urge the Congress that it make ample provision for the expenses of such a commission, and that it hold in abeyance all proposed legislation affecting the patent system in whatsoever way until such time as the said commission shall have had ample opportunity to hold the said hearings and make the said study and report."

Ontario Hydroelectric System to Be Enlarged

At a session of the Hydro-Electric Power Commission of Ontario held in Toronto, Ont., July 30, it was decided to enlarge the transformer station at Niagara Falls, Ont., and to double the line between Dundas and Niagara Falls. This will give the engineers the equipment to double the lines between London and Dundas. The towers are already built and the stringing of the double line to supply the western portion of Ontario with Niagara energy will be commenced at once. The estimated cost of the work is $300,000.

Michigan Electrical Convention

The annual convention of the Michigan Section of the National Electric Light Association will be held in the Hotel Ottawa at Ottawa Beach, Mich., on Aug. 19, 20 and 21. While the program has not been definitely fixed in all details, many of the speakers and topics have already been selected. The opening address will be made by President F. B. Drees, Lansing, Mich.

The following papers will be read: "Relation Between Central Station and Electrical Contractor," Mr. C. J. Litscher, of the C. J. Litscher Electric Company, Grand Rapids; "Electrical Heating Devices," by a writer not definitely chosen; "Indirect and Semi-Indirect Lighting," Mr. James R. Cravath, consulting engineer, Chicago; "The American Kicker," Mr. D. B. South, Edison Illuminating Company of Detroit; "Two Epochs of Rate Regulation," Mr. W. J. Norton, of Chicago, secretary rate research committee, N. E. L. A.; address by Mr. James V. Oxtoby, a Detroit lawyer; address by Hon. Lawton Heemans, member of the Railroad Commission of Michigan; address by Mr. T. C. Martin, secretary of the N. E. L. A.; address by a member of the Industrial Accident Board of Michigan; "High-Tension Distribution to Small Communities," Mr. T. A. Kenney, Au Sable Power Company, Kalamazoo; "Au Sable Power Plant and Transmission Line," by an employee of the Commonwealth Power Company, Jackson, Mich.; "High-Tension Distribution by One-Wire Grounded System," Mr. J. A. Cavanaugh, Benton Harbor Electric Light & Railway Company; "Automatic Pumping Station at Farmington, Mich.," Mr. Addison Cary, Eastern Michigan Edison Company, Rochester, Mich.; "Efficient Application of Motor Drive," Mr. W. J. Fitzgerald, Edison Illuminating Company of Detroit; "Street Lighting," Mr. D. W. Hayes, Eastern Michigan Edison Company, Ann Arbor; "Wiring Campaigns," by an employee of the Eastern Michigan Edison Company. Mr. William Trott, of Grand Rapids, will supervise a rejuvenation of the Jovian Order on the evening of Aug. 20. Mr. Herbert Silvester, 18 Washington Boulevard, Detroit, is secretary of the association.

Opposition to Camden Municipal Plant

On account of the fact that the estimate prepared by Runyan & Cary, the city engineers, for a municipal electric-lighting plant at Camden, N. J., showed the cost of erection to exceed $500,000, while the original estimate was less than $200,000 when the citizens voted in favor of a municipal plant in 1906, the City Council called a meeting of the citizens on July 31, 1913, in order to determine the present sentiment concerning the proposition. As a result of this meeting the Council voted not to authorize the erection of the plant at present but to resubmit the proposition to the voters at the election in November, 1913.

Opposition to the proposed municipal plant was led by the Camden Board of Trade, which had made a special investigation of a large number of municipal plants throughout the country. In its communication to the citizens the Board of Trade claimed that it had failed to find any municipal plant giving satisfaction to the people, but, on the other hand, had found them greatly overmanned, usually for political reasons, and heavy tax burdens on the people, and it argued that this would prove true in Camden should such a plant be built.

The committee of the Board of Trade having the investigation in charge opposed the scheme because it would increase the taxes very materially, the burden of which the business man would have to pay. The board opposed the city plant also because there has been a reduction of $29.50 per lamp since the vote was taken seven years ago and according to a schedule issued in 1912 this amount can be further reduced. A report recently issued by the Board of Trade demonstrated that the city can purchase street lighting for $33,780 less than it can operate a plant exclusively for this purpose, according to the city's own experts.

The most effective argument against the proposed plant was presented by Mr. Frederick A. Finkeldey, chairman of the municipal electric-light committee, who explained that he had brought the subject forward at this time as a means rather than an end. His opposition to a municipal plant was based on the impossibility of divorcing its management from politics. He asked the councilmen if they believed that the various city departments were as well managed as their own individual businesses, and stated emphatically that city employees selected under political influence cannot possibly operate a plant requiring engineering training and experience so well as it can be operated by a private company that selects and promotes its employees solely on merit. The object in agitating the subject—namely, to obtain a suitable reduction in the charges for lighting service—having been accomplished, Mr. Finkeldey urged the councilmen to cast their votes against the municipal plant.

The ordinance appropriating $540,000 for the municipal electric-lighting plant was thereupon rejected by a vote of 13 to 10.

Canadian Railway Commission to Regulate Rates

The newly consolidated railway act, which has just been completed by Mr. Samuel Price, of St. Thomas, Ont., embracing all amendments since the original act was passed, and which will be introduced at the next session of the Canadian Parliament, contains important provisions for the protection of public and municipal rights. Henceforth no company can erect telephone, telegraph or electric wires without the consent of the municipality, and rates must be approved by the Railway Commission. Heavy penalties are provided for companies and their officers, as well as mayors and other municipal officials, who disobey the orders of the Railway Commission.

Canadian Conservation Commission Opposed to Private Development at Long Sault

The report of the Canadian Conservation Commission on the Long Sault power development scheme on the St. Lawrence will shortly be ready for submission to the government. It will declare emphatically against such an undertaking being turned over to any company, and that if the power is harnessed it should be done by the government. The engineers have found the scheme quite feasible from their standpoint, but there would be danger to navigation as well as risk of flooding adjacent territory. The immense value of the power as a natural resource will be emphasized, together with a declaration that its export from the country should not be permitted. The report is now being revised by Hon. Clifford Sifton, chairman of the commission. It will be recalled that the Aluminum Company of America's charter granted by the State of New York authorizing it to make the development at the Long Sault Rapids in the St. Lawrence River was declared void by Attorney-General Carmody of New York on Jan. 1.

Dominion Water-Power Investigations

The Canadian government has retained Mr. C. S. McInnes, of Toronto, Ont., to represent it in preparing the case to be submitted to the International Waterways Commission with reference to the projected damming of St. Mary's River at Sault Ste. Marie by the Michigan Lake Superior Power Company. A commission of engineers, consisting of Messrs. W. A. Bowden, of the Railway Department; Jefferson Chapleau, of the Public Works Department, and W. J. Stewart, of the Hydrographic Survey, has been appointed to secure data upon which the case will be based.

Messrs. J. B. Challies, superintendent of the Dominion Water Powers Branch, and S. J. Robins, assistant private secretary to the Minister of the Interior, have been sent to Victoria, B. C., by the Canadian government to consult with the British Columbia government with regard to water-powers in the railway belt. The ownership of certain water-powers there has not yet been clearly defined. Both the federal and the provincial governments claim ownership, and a discussion has been going on for some time, more particularly as to whether the Dominion or the provincial government has jurisdiction over the Hudson Hope Power Company.

Complaint of Slowness of Electrical Inspection in Louisville, Ky.

Electrical contractors and central-station men in Louisville, Ky., are interested in the inspection situation, because of complaints of real-estate men that the work was not being done rapidly enough by the city inspectors. This brought out the fact that the Kentucky Actuarial Bureau, the rating organization of the fire underwriters, is no longer making inspections free of charge, but has put the work on a fee basis. This has resulted in the work being offered to the city inspectors in greater volume than heretofore, the inspectors of the bureau, whose reports are accepted by the central stations and the city, being called on for service only in connection with the more remote installations. It is said that the city inspectors are six weeks behind in their work, and as the lighting companies will not give service until after the installations have been passed on by the inspectors, considerable inconvenience has been caused. The Actuarial Bureau is developing its electrical inspection work out in the State, where little attention has been paid to the inspection of wiring by city and town authorities, and will appoint several more men and put a chief in charge of that department of its work.

Kansas Cities Reject Condemnation for Public Ownership

The mayors of twenty-three eastern Kansas cities, called to Topeka, Kan., for a conference with the Governor on July 31, refused to indorse a proposal for a campaign of public ownership for municipal gas service and pipe lines for natural gas through condemnation proceedings. The Kansas Natural Gas Company, which furnishes forty cities with gas, is now in the hands of receivers and no gas contracts with producers are being made for next winter because the Public Utilities Commission refuses to permit an increase in price. The administration proposes to call the Legislature and pass special enabling acts to allow the condemnation of $30,000,000 worth of gas-company properties. After some discussion the mayors rejected the public-ownership proposal and adopted resolutions petitioning the federal court to turn the Kansas Gas properties over to State receivers and permit them to make arrangements for next winter's gas supply.

Minnesota to Consider Public Utility Bill

Governor A. O. Eberhart of Minnesota has completed his keynote speech on the public utilities question, and it is expected that he will deliver it in St. Paul about Aug. 15. No announcement has been made as to when the Governor will call a special session of the Legislature to consider a public utilities measure, but it has generally been supposed that the law-making body will convene in October.

Maine to Vote on Utility Board

The acceptance or rejection of the act passed at the last Legislature providing for a Board of Public Utilities will be determined by a referendum at the next general election in September, 1914. Governor Haines set the date in a proclamation issued July 29. The law, which would have gone into effect on July 12 last, was automatically suspended when a petition with more than 10,000 signatures demanded a referendum.

Appointments to Pennsylvania's Public Service Commission

The members of Pennsylvania's Public Service Commission, which is to supersede the State Railroad Commission, have been appointed by Governor Tener. The commission is made up of the following: Messrs. Nathaniel Ewing, Fayette County, chairman, ten-year term; S. L. Tone, Allegheny County, nine-year term; Samuel W. Pennypacker, former Governor, eight-year term; Emory R. Johnson, Philadelphia, professor of transportation and commerce expert, University of Pennsylvania, seven-year term; Mil-

ton J. Brecht, Lancaster County, six-year term; Charles Frederick Wright, Susquehanna, five-year term; Frank M. Wallace, Erie, four-year term. There are three members of the new commission that served upon the State Railroad Commission, Messrs. Ewing, Pennypacker and Brecht.

Oklahoma Demands Telephone Trunk-Line Connections

Oklahoma filed on Aug. 1 with the Interstate Commerce Commission at Washington a complaint against the monopolistic practices of the American Telephone & Telegraph Company. The complaint was brought by the Corporation Commission of Oklahoma in behalf of the Arnett Telephone Company, an independent organization in that State, and it was asserted that since July 12, 1912, the American Telephone & Telegraph Company has refused to grant connections to the Arnett Telephone Company with its subsidiaries in Oklahoma and adjoining states. The Interstate Commerce Commission was petitioned to investigate the matter and force the American Telephone & Telegraph Company to grant through routes in connection with the Arnett company from points in Oklahoma to interstate points.

Public Service Commission News

New York Commissions

The Public Service Commission for the First District has executed a contract with the E. E. Smith Contracting Company, the lowest bidder, for the construction of that section of the Broadway (Manhattan) subway lying between Union Square and Twenty-sixth Street. The total amount of the Smith company's bid was $2,056,702.50. The plans call for a four-track underground railroad with one-half of the express station at Union Square and a local station at Twenty-third Street and Madison Square.

Massachusetts Commission

The Massachusetts Gas and Electric Light Commission has issued a decision, on the petition of consumers of the Edison Electric Illuminating Company of Brockton, reducing the maximum net price of electricity from 15 to 12 cents per kw-hr. The company is one of the Stone & Webster properties. The previous price applied to residence and office lighting and covered the first thirty hours' monthly use of the connected load, all energy in excess of such use being billed at 9 cents net. The rates for factory lighting ranged from 10.8 cents net to 9 cents net, depending upon the connected motor load. The company also had various other rates not bearing closely upon the points before the board. The complainants at the hearings were mainly lighting customers using electricity in small amounts and the company's use of the connected load as the basis of its demand charge was criticised. By the rate system previously in force, as the ratio of consumption to connected load increased the average price per kilowatt-hour decreased. In its opinion the board states that lengthy use of a given demand has an influence upon the company's costs, but that a mere difference in the quantity used does not justify a difference in price, and that differences in lamp installations are exceedingly unreliable indications of actual differences in demand. Nearly 90 per cent of the company's customers were interested in the maximum net price of 15 cents and more than half of these did not secure the secondary rate. Even those business and residence customers entitled to the secondary rate paid average prices exceeding 11 and 12 cents respectively. The board is of the opinion that the customers who are dependent upon the company for their supply do not use electricity under conditions so unlike as to make a uniform meter rate work any injustice to them and that there is not sufficient advantage in the present two-rate system for small users to compensate for the complications introduced, especially when the basis for its application is the connected load determined by the watts of the installed lamps. The commission contends that the value of the small user to the company, particularly in residence lighting, and the importance of lower prices to develop this class of business, have been underestimated.

In 1908 the company erected a new generating plant, and since then the volume of its annual output has increased from 2,795,824 kw-hr. to 7,586,582 kw-hr., while its net earnings from the sale of electricity have increased from $82,823 to $131,825. Its interest and dividends have increased from $44,649 to $93,194, and the dividend rate from 6 to 8 per cent. In reducing the maximum net price to 12 cents, dating from Aug. 1, 1913, the board holds that, after the payment of reasonable operating expenses and depreciation, the revenue will yield a fair return upon the value of the property.

Wisconsin Commission

A decision in the case of the city of Green Bay versus the Green Bay Gas & Electric Company has been issued by the commission. In this case, the properties of the defendant and its associated companies, the Green Bay Traction Company, the Northern Hydro-Electric Company and the Wisconsin Public Service Company, were considered together in arriving at a uniform and reasonable rate schedule in lieu of the several schedules in controversy. The present value of the total property was fixed by the commission at $2,373,457 and the cost of reproduction at $2,788,875. After allowing a fair rate for interest and depreciation, the commission found that the total cost of operating the hydroelectric plant is more than the present revenue and more than it usually costs to produce the service by steam power. It was pointed out that, although the load factor of the electric service is good as a whole, the amount of business that the respondent now has is not sufficient in comparison with the size of the plant to reduce the unit fixed costs to an amount that can properly be considered the basis for fixing rates. An estimate was made of the expenses of the plant using steam power, which costs were found to be lower and about the same as the present revenues. The commission, therefore, held that no changes should be made in the present revenue of the electric department but that certain changes should be made in the schedule of charges. The various schedules for electric service now in effect were ordered abandoned and the following uniform schedule substituted: Primary rate, 10 cents net per kw-hr. for the first 30 hours' use per month of the active connected load; secondary rate, 8 cents net for the next 60 hours' use; excess rate, 4 cents. The gross rate is to be one cent higher, the difference constituting a discount for prompt payment. The minimum bill is to be $1 per month. The rate for all sign and window lighting will consist of a charge of 5 cents net per active 50-watt lamp or its equivalent per month plus a charge of 4 cents net per kw-hr. for energy consumed, and all lamps are considered active. The classification of consumers according to the percentage of active connected load is essentially the same as that in the Lake Geneva decision.

From the investigation of the gas department it appeared that certain reductions could be made in the schedule of charges. The present practice of charging different rates for gas when used for fuel or illuminating purposes, necessitating the use of two meters, was ordered abolished and the following schedule prescribed: First 1000 cu. ft. per month, $1.15 net; second 1000 cu. ft., $1.05 net; next 3000 cu. ft., $0.95 net; all over 5000 cu. ft., $0.90 net. The minimum bill will be 40 cents. No change was ordered in the rates for motor service nor the rates for street lighting.

Current News Notes

Camping by Electricity.—A central station in an English seashore town has put in practice this summer a plan that makes tenting on the seashore more of a joy than ever. Service wires have been run to the best locations for camping to provide for electric cooking and electric light. A flat charge of $2.50 is made for all-summer service at each tent, and for this charge a limited number of lamps may be used as much as is desired and all the cooking may be done on electric stoves.

* * *

International Conference on Engineering Standards.—A conference will be held between representatives of the Engineering Standards Committee of Great Britain, of the standards committee of the American Institute of Electrical Engineers, and of the United States committee of the International Electrotechnical Commission, looking toward co-operation between these committees, on Saturday, Aug. 23, at the London office of the Engineering Standards Committee of Great Britain, 28 Victoria Street, Westminster, S. W., London, England.

* * *

May Vote by Electricity.—Representative Walsh has suggested a voting scheme to the House rules committee of Congress which will do away with the dreary and protracted roll call. Mr. Walsh would have an electric bulletin board installed with an alphabetical list of the names of all the members posted, each of which will have two bull's-eye lamps—one red, which, when flashed, would indicate that the member has voted yea, and the other blue, which would signal the intention of the member to vote nay. The total on the board would be automatically added and the House could see at a glance how every member voted, together with the result.

* * *

Railway Appraisal Costly.—Physical valuation of the railroads of the United States by the Interstate Commerce Commission will occupy from five to seven years and will cost the government from $10,000,000 to $15,000,000, according to the plans that the commission has presented to the House appropriations committee. The commission has asked for an immediate appropriation of $1,500,000 for the organization of the corps of engineers to undertake the work, and Commissioners Clements and Prouty have stated that a carefully worked-out estimate places the cost of the field work at $1,921,500 a year throughout the period. The plan is to divide the country into five districts, each containing approximately 50,000 miles of railroad.

* * *

Sandusky Defeats Proposed Bond Issue for Municipal Lighting Plant.—A proposal that bonds to the amount of $200,000 be issued to provide for a municipal electric-light plant was defeated by the voters of Sandusky, Ohio, at a special election on July 30. The Sandusky Gas & Electric Company, under the direction of Vice-president C. B. Wilcox, made a campaign against the proposed bond issue, and its arguments prevailed with the electorate. The rates in Sandusky are 8 cents and 5 cents per kw-hr. for lighting and motor service, respectively. The company refused to accept rates of 5 cents and 3 cents as proposed by a recent ordinance. It appealed to the Public Service Commission of Ohio. The city retaliated by the municipal-ownership proposition which the citizens have just voted down.

* * *

German Restrictions on Private Wireless.—The German Post Office and Interior Departments have promulgated elaborate regulations in order to prevent owners of private wireless-telegraph stations from engaging in traffic which might injure the interests of the national defense. Private stations may be erected only on condition that the government have the right at any time to order their demolition. The owners must pledge themselves to guarantee the absolute secrecy of any messages their stations may happen to pick up and must agree to render special service whenever they intercept messages relating to disasters. Officers of the army and the navy are to have the privilege at any time to inspect stations and order a temporary cessation of activities, and the stations themselves must be placed at the disposal of the government as often as occasion demands.

* * *

SOCIETY MEETINGS

Annual Convention of the Indiana Association.—The Indiana Electric Light Association will hold its next annual meeting at Indianapolis Sept. 24 and 25. Mr. J. V. Zartman, 49 Lombard Building, Indianapolis, Ind., is secretary of the society.

* * *

Pennsylvania Section, N. E. L. A., Annual Meeting.—The sixth annual convention of the Pennsylvania Electric Association (State branch of the N. E. L. A.) will be held at the Water Gap House, Delaware Water Gap, from Sept. 15 to 18. An attractive program has been arranged, and indications point to an unusually large attendance. Mr. Walter E. Long, 1000 Chestnut Street, Philadelphia, is secretary of the Pennsylvania Section.

* * *

Officers of Missouri Electrical Contractors' Association.—At the recent St. Louis meeting of the Electrical Contractors' Association of the State of Missouri, reported in these columns July 19, the officers of the association were re-elected for the ensuing year. They are as follows: President, Mr. L. E. Reed, St. Joseph; vice-president, Mr. William F. Koeneman, St. Louis; secretary, Mr. A. J. Burns, Kansas City; treasurer, Mr. A. Penn Denton, Kansas City; sergeant-at-arms, Mr. W. T. Davies, Kansas City; director, Mr. Ernest S. Cowie, Kansas City.

* * *

Municipal Electricians to Convene.—The eighteenth annual convention of the International Association of Municipal Electricians will be held at Watertown, N. Y., from Aug. 19 to 22, with headquarters at the New Woodruff Hotel. The exhibits will be made in the Odd Fellows' Temple. Many subjects of wide interest will be discussed at this meeting, such as electrical inspection, municipal street lighting, fire-alarm and police signaling, joint use of poles, permissible voltage on overhead wires in cities, municipal ownership and electrolysis. Mr. Clarence R. George, Houston, Tex., is secretary of the association. Mr. H. C. Bundy, superintendent of fire alarm, of Watertown, N. Y., is chairman of the executive committee.

* * *

Detroit Engineering Society.—The Industrial Electrical Engineering Society of Detroit, Mich., was organized last winter. The membership comprises the chief electricians and their assistants at the various electrical plants in Detroit and salesmen doing business with the various industrial plants. The society has now about 100 members. Meetings are held twice a month. The aim of the society is social and educational. At the meeting held Aug. 1 Mr. A. E. Meyer, assistant electrical engineer of the Edison Illuminating Company, presented a paper entitled "Some Phases of Alternating-Current Machinery." The officers of the association are: President, Mr. F. Allison, chief electrician Ford Motor Company; vice-president, Mr. A. E. Roach, Edison Illuminating Company; secretary, Mr. C. E. Wise, district manager Cutter Electrical & Manufacturing Company; assistant secretary, Mr. G. R. Clover, district manager Cooper Hewitt Electric Company; financial secretary, Mr. J. G. Plasko, chief electrician Parke, Davis & Company, and treasurer, Mr. C. W. Krause, chief electrician Packard Motor Car Company. The offices of the society are in the Stevens Building, Detroit.

Hydroelectric Plant on White Salmon River

System of Northwestern Electric Company—Immense wood-stave pipe employed—Company to supply electricity and steam heat in Portland, Ore. By Wilbur B. Foshay

THE Northwestern Electric Company, a corporation made up of San Francisco and Portland capitalists, with the control of the company in the hands of Messrs. Mortimer and Herbert Fleishhacker, of San Francisco, and with main offices in Portland, Ore., has completed and put in operation a power plant on the White Salmon River, at a point about 3 miles above the mouth of the river where it empties into the Columbia.

In arranging for making this development one of the first engineering feats that the Stone & Webster Engineering Corporation, which constructed the plant, had to overcome was that of preparing a suitable road for a distance of some 3 miles from Underwood station, on the Spokane, Portland & Seattle Railway, to the site of the power house and dam. This road had to cross the White Salmon River, and to do so a bridge of about 115 ft. in length and some 90 ft. above the river had to be constructed and made strong enough to carry all the heavy material needed in the building of the plant. When it is taken into consideration that the rotors for the 6000-kva machines installed in this plant had to be hauled across this bridge, some idea can be formed of the strength necessary in the structure.

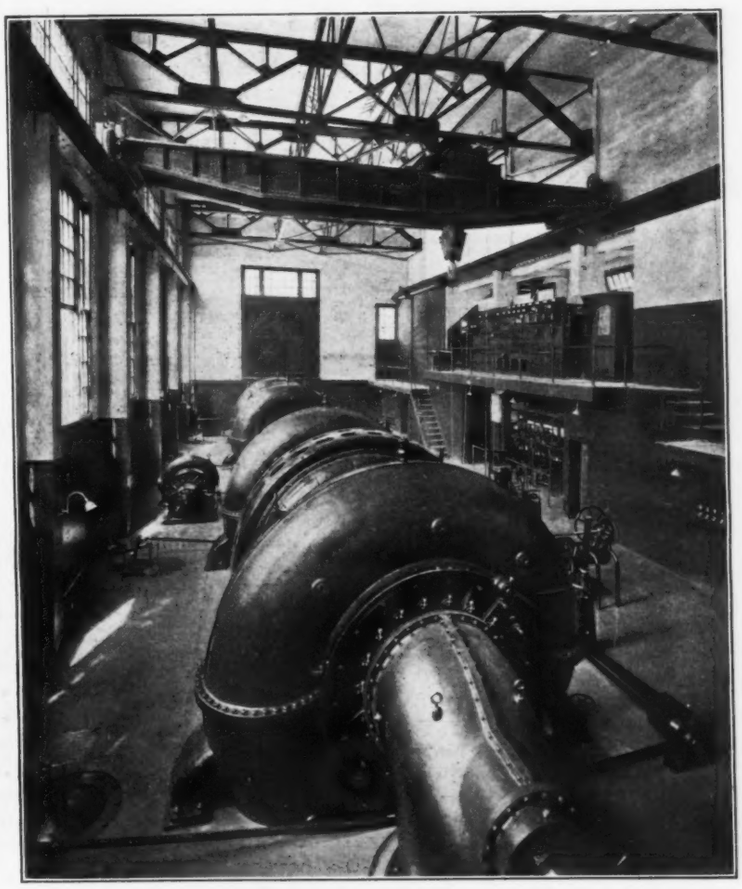


FIG. 1—CONDIT STATION OF THE NORTHWESTERN ELECTRIC COMPANY

The dam proper is about a mile above the power-house site and is constructed between two stone walls of natural formation at a point where the river flows through a deep cut. This dam is 60 ft. long at the bottom and 470 ft. at the top. It is 96 ft. through at the bottom and 15 ft. at the top. The height of the dam from bedrock is 125 ft. and it contains about 30,000 cu. yd. of concrete. During the construction of the dam there were placed rock crushers and sand machines on the hillside above the dam site, the rock being hauled with a Bagley scraper into the rock crusher and ground to the proper size, a portion of this rock then passing by gravity into the sand machine and being pounded into sand, which in turn was carried into the mixer by gravity. Here cement and water were added to the sand and crushed rock, and the resulting concrete was carried by gravity to its proper place in the dam 100 ft. below. In this way after the material entered the rock crusher it was not touched by human hands again, but traveled of its own weight through the various processes in troughs until it reached its proper place in the dam.

From the dam site to the power house a mile below the water is carried in a wood-stave pipe 13.5 ft. in diameter. This is said to be the largest wood-stave pipe of which any record can be found. The pipe was constructed and installed by the Pacific Coast Pipe Company. This large wood-stave flume is constructed on a hydraulic grade, the pipe resting in cradles set on concrete foundations, these cradles being about 4.5 ft. apart. At a point about 700 ft. from the power house it is reduced to two 9-ft. pipes, and at a point some few hundred feet nearer the power house steel-riveted pipes are employed which continue to the power house proper. An illustration is given herewith of the interior of this 13.5-ft. wood-stave pipe. In planning the pipe the greatest difficulty to be overcome was that of protecting against any chance of the pipe flattening when filled with water at a low pressure. To prevent this, cradles were placed along the pipe, as mentioned above, and no trouble has arisen due to the size of the pipe and the low pressure of the water carried therein. From the illustration showing this pipe line the cradles referred to can be easily distinguished.

GENERATING STATION

The power house itself is located directly on the river bank and a working head of 177 ft. is secured. The structure proper is built of concrete and steel, the building being approximately 70 ft. by 150 ft.

The waterwheels are of the Francis type, manufactured by the Allis-Chalmers Company. There are two to each generator, one turbine being located on either side of the generator. The entire unit made up of the two turbines

and a generator, which is also of Allis-Chalmers manufacture, is carried on two bearings, one each side of the generator, the shaft extending through the discharge pipes of the turbines, which are one-quarter turns. In the discharge pipes there are thrust bearings, and while these bearings carry no weight in the operating of the units, in case it is necessary either turbine can be taken down and the other unit used to operate the generator, so that during a repair to one turbine unit the generator will be operated at half load. There are two units with a rating of about 10,000 hp each installed, and with the generating units made up as explained, the plant can be operated at the greatest efficiency at one-quarter, one-half, three-quarters or full load.

FIG. 2—DAM AND GATEHOUSE ON WHITE SALMON RIVER

In the same power house are the transformers for stepping the potential up from 2300 volts, at which it is generated, to 66,000 volts for transmission to the city of Portland. The switching apparatus, etc., is also situated in the power house. The transformers and switching apparatus were furnished by the General Electric Company.

Auxiliary Steam Station

From the plant to the river crossing the pole line is completed and in operation as far as Camas, at which point 4000 hp is now being served to the Crown Columbia Paper Mill, one of the largest paper mills on the Pacific Coast. At Camas the pole line will cross the Columbia River, the towers for this line now being in place and completed. The tower crossing consists of five supporting towers and four strain towers, the height of the towers being 140 ft. The material for the construction of the line into the city of Portland has all been ordered and is in the course of shipment at the present time, as is also the equipment for a steam auxiliary plant to be located in the new Pittock Block, in the heart of the city of Portland, where will also be located the direct-current converting station. The steam auxiliary plant will have boiler equipment sufficient to carry the two 3750-kw General Electric turbines that have been ordered.

FIG. 3—WOOD-STAVE PIPE LINE

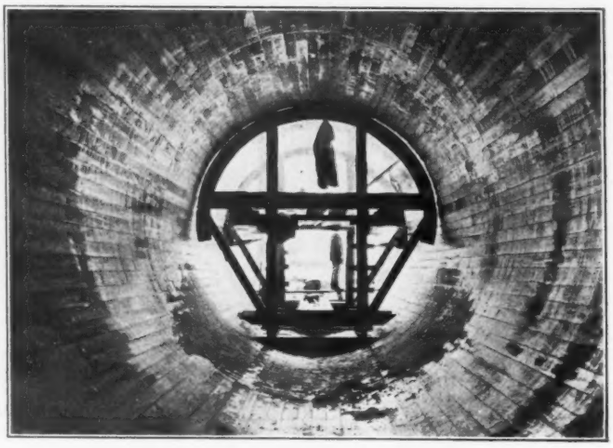


FIG. 4—INTERIOR OF STAVE-PIPE LINE

The Northwestern Electric Company has obtained a steam-heating franchise from the city of Portland, and a contract has been given to the American District Steam Company, of North Tonawanda, N. Y., for the construction of the steam-heating mains. This work will proceed with the installation of an underground conduit system for the use of the electric department of the company in its underground distributing system.

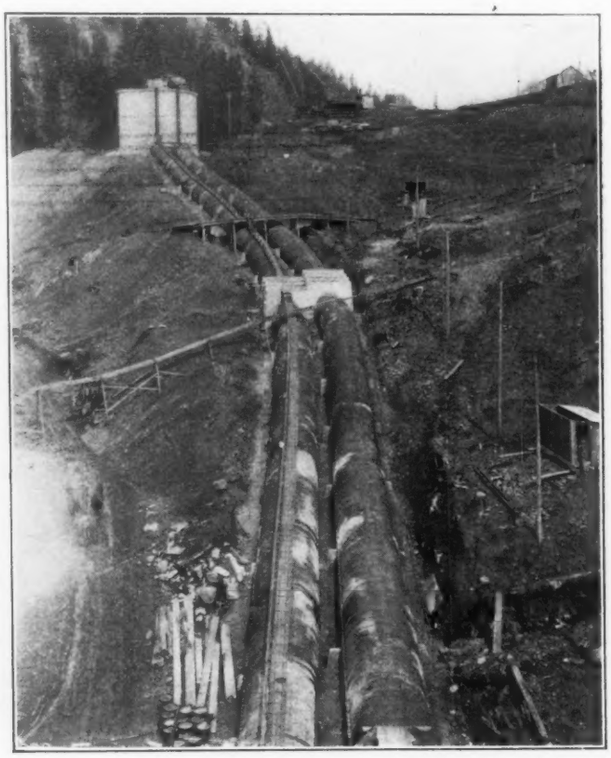


FIG. 5—FOREBAY AND STEEL PIPE LINE

The entire system, including power site, pole line and steam plant in Portland, has been located and designed under the direction of Mr. B. C. Condit, a San Francisco

engineer, who has been connected with the Fleishhacker interests for many years, and in honor of whom the hydroelectric station is named. The hydraulic development was made by the Stone & Webster Engineering Corporation on contract and was in charge of Mr. J. H. Manning, of that company. The vice-president and general manager of the Northwestern Electric Company is Mr. Wilbur E. Coman.

Design of an 1180-Ft. Transmission-Line Span

By K. NOGAMI

The Ondo section of the city of Hiroshima in southern Japan is to be lighted by the Chugoku Electric Light Company, whose transmission circuits will be required to cross the famous strait of Ondo Kaikyo with a single span 1180 ft. in length. Navigation regulations specify that the lowest point of the span wire shall be at least 130 ft. above the highest tide, affording ample clearance for the passage of vessels.

Following are the calculations for this installation based on the formula of Mr. Harold Pender appearing in the *Proceedings* of the American Institute of Electrical Engineers for June, 1911. Snow is rare in southern Japan, so in this case possible effects of sleet and ice were neglected. Under the requirements of the Japanese government, however, allowance was made for such severe wind forces as 40 lb. per sq. ft.

In the formula

w = weight of wire per foot in pounds.

d = diameter of wire in inches.

i = thickness of ice in inches.

v = wind pressure in pounds per square foot perpendicular to the wire.

K = ratio of total force on the wire to weight of wire under these conditions.

Then

$$K = \sqrt{\left\{1 + \frac{1.24\, i\,(d+i)}{w}\right\}^2 + \left\{\frac{v\,(d+2i)}{12\,w}\right\}^2}.$$

If the effect of ice be neglected, then

$$K = \sqrt{1 + \left(\frac{vd}{12\,w}\right)^2}.$$

m = weight in pounds of bar of conductor, 1 ft. long and of 1 sq. in. section.

T = tension of wire in thousand pounds per square inch at the lowest point.

L = length of span in feet, i. e., horizontal distance between the points of supports.

l_o = distance of the lowest point from one of the supports.

D = deflection in feet of the lowest point from the horizontal line through the two points of support, when points of supports are at the same level.

$p = \frac{100\,D}{L}$ percentage deflection when the supports are at the same level.

K' = the value of K when there is no wind: in this case $K' = 1$.

h = difference in elevation in feet of the two points of supports.

D_1 = deflection in feet of the lowest point in the direction of resultant force from the horizontal line passing through the lower support.

s_1 = vertical sag corresponding to the deflection D_1.

M = modulus of elasticity.

a = coefficient of expansion.

t_o = lowest temperature in winter.

t = highest temperature in summer.

When the supports are at the same level, then

$$D = \frac{K\,m\,L^2}{8000\,T} \qquad (1)$$

$$p = \frac{K\,m\,L}{80\,T}$$

When the supports are at the different level, then

$$D_1 = D\left(1 - \frac{K'h}{4\,KD}\right)^2 \qquad (2)$$

The vertical sag corresponding to D_1 is

$$s_1 = \frac{K'D_1}{K} \qquad (3)$$

$$L_o = \frac{L}{2}\left(1 - \frac{K'h}{4\,KD}\right) \qquad (4)$$

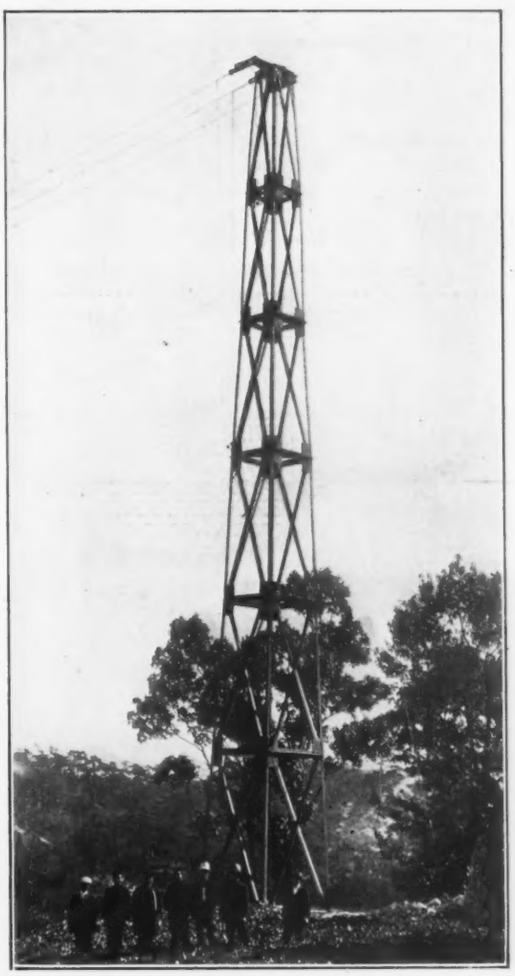


FIG. 1—STEEL TOWER AND SECTION OF SPAN

For tracing the curve, we have

$$Y = \frac{Kmx^2}{2000\,T} \qquad (5)$$

Taking into consideration the effect of temperature, we have the following formula:

$$\left(p^2 - \frac{3.75 \times 10^6 T}{M}\right) - \left(p_o^2 - \frac{3.75 \times 10^6 T_o}{M}\right)$$

$$= 3750\,a\left\{(t - t_o) - \frac{h^2}{2\,aL^2}\left[\left(\frac{K'}{K}\right)^2 - \left(\frac{K_o'}{K_o}\right)^2\right]\right\} \qquad (6)$$

Whence, when the tension T_o at temperature t_o and loading K_o are given, the tension T at any other temperature t and

loading factor K may be determined by solving this equation after substituting:

$$p = \frac{KmL}{80\,T} \qquad \text{and} \qquad p_o = \frac{K_o mL}{80\,T_o}$$

In the case of the Ondo Kaikyo span, the distance from shore to shore is pretty long, and a straight stranded steel wire was used. The data given follow:

Span, 1180 ft.
Difference in elevation of supports, 47.2 ft.
Steel wire, stranded:
Diameter, 7/16 in.
Weight per foot, 0.30 lb.
Breaking strain, 150,000 lb.
Weight of steel bar, 1 ft. long and 1 sq. in., 3.4 lb.
Modulus of elasticity, 30×10^6.
Weather conditions:
Wind pressure, 40 lb. per sq. ft.
Ice, none.

According to Japanese government regulations, the wire must be stretched with only such tension that the safety factor shall be more than five when the temperature is the lowest.

In our case the safety factor is taken as ten, therefore, using a tension of 15,000 lb. per sq. in., the lowest temperature will be 10 deg. Fahr. and the wind pressure zero.

Then we have

$$K = K' = 1.$$

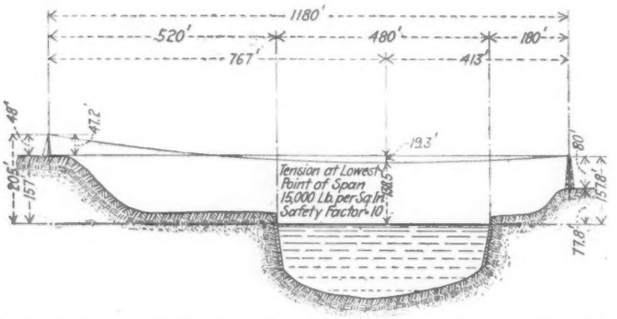


FIG. 2—ELEVATION ON SPAN, WINTER—10 DEG. FAHR., NO WIND

The sag when the supports are at the same level,

$$D = \frac{KmL^2}{8000\,T} = \frac{3.4 \times 1180^2}{8000 \times 15} = 39.4 \text{ (see 1)}.$$

The sag in our case,

$$D_1 = D\left(1 - \frac{K'h}{K \times 4 \times D}\right)^2 = 39.4\left(1 - \frac{47.2}{4 \times 39.4}\right)^2 = 19.3 \text{ (see 2)}.$$

$$L_o = \frac{L}{2}\left(1 - \frac{K'h}{4 \times K \times D}\right) = \frac{1180}{2}\left(1 - \frac{47.2}{4 \times 39.4}\right) = 413 \text{ (see 4)}.$$

For tracing the curve,

$$Y = \frac{KmX^2}{2000\,T} = \frac{3.4 \times X^2}{2000 \times 15} = 0.000113\,X^2 \text{ (see 5)}.$$

The height of the lowest point above the sea level at highest tide,

$$(157 + 48) - (47.2 + 19.3) = 138.5.$$

If the wind pressure be taken into consideration, the calculation becomes as follows:

$$K = \sqrt{1 + \left(\frac{vd}{12 \times W}\right)^2} = \sqrt{1 + \left(\frac{40 \times 0.437}{12 \times 0.30}\right)^2} = 4.9.$$

In the formula (6),

$$\left(p^2 - \frac{3.75 \times 10^6\,T}{M}\right) - \left(p_o^2 - \frac{3.75 \times 10^6 T_o}{M}\right) = 3750\,a\left\{(t - t_o) - \frac{h^2}{2\,aL^2}\left[\left(\frac{K'}{K}\right)^2 - \left(\frac{K_o'}{K_o}\right)^2\right]\right\}$$

$$p = \frac{KmL}{80\,T} = \frac{4.9 \times 3.4 \times 1180}{80\,T} = \frac{245}{T}$$

$$p_o = \frac{K_o mL}{80\,T_o} = \frac{3.4 \times 1180}{80 \times 15} = 3.34$$

$$t - t_o = 0$$

$$\left(\frac{K'}{K}\right)^2 - \left(\frac{K_o'}{K_o}\right) = \left(\frac{1}{4.9}\right)^2 - 1 = -0.06$$

$$\therefore \left(\frac{245^2}{T^2} - \frac{3.75 \times 10^6}{30 \times 10^6} \times T\right) - \left(3.34^2 - \frac{3.75 \times 10^6 \times 15}{30 \times 10^6}\right) = \frac{47.2^2}{2 \times 1180^2}(-0.06) \times 3750$$

$$\frac{60{,}025}{T^2} - 0.125 \times T = 9.455$$

From which we see T is approximately equal to 60.

$$\text{The safety factor } \frac{150}{60} = 2.5.$$

If the wind pressure be taken into account, the tension increases and the safety factor reduces to 2.5.

But, by the foreign practice, momentary maximum allowable tension is usually taken at one-half of the ultimate strength of the wire. (See Dr. Harold Pender's paper, *Proceedings*, A. I. E. E., June, 1911.) Even in heavy wind pressures of 40 lb. per sq. ft. (which seldom occur), the tension of the wire in this case would be far within the safety limit.

Sag when the supports are at the same level,

$$D = \frac{KmL^2}{8000\,T} = \frac{3.4 \times 1180^2 \times 4.9}{8000 \times 600} = 48.2$$

In our case,

$$D_1 = D\left(1 - \frac{K'h}{4\,KD}\right)^2 = 48.2\left(1 - \frac{47.2}{4.9 \times 4 \times 48.2}\right)^2 = 43.6.$$

Vertical sag corresponding to this sag:

$$s = \frac{K'D_1}{K} = \frac{1}{4.9} \times 43.6 = 8.9.$$

Inclination of the wire to the vertical plane:

$$\cos\varphi = \frac{8.9}{43.6} = 0.22,$$

or

$$\varphi = 77 \text{ deg. } 15 \text{ min.}$$

$$L_o = \frac{L}{2}\left(1 - \frac{47.2}{4 \times 4.9 \times 48.2}\right) = 590 \times 0.95 = 560.5.$$

In the summer time we shall see how much the tension reduces and the safety factor increases:

Maximum temperature, 100 deg. Fahr. Wind pressure, 0.

In the formula (6),

$$K = K_o = 1$$

and

$$p = \frac{KmL}{80\,T} = \frac{3.4 \times 1180}{80\,T} = \frac{50}{T}$$

$$p_o = \frac{K_o mL}{80\,T_o} = \frac{3.4 \times 1180}{80 \times 15} = 3.34$$

The formula becomes:

$$\frac{50^2}{T^2} - 0.125\,T = 12.005$$

From which we see T is approximately equal to 13.5.

$$\text{The safety factor } \frac{150}{13.5} = 11.$$

The sag when the supports are at the same level,

$$D = \frac{KmL^2}{8000\,T} = \frac{3.4 \times 1180^2}{8000 \times 13.5} = 43.8.$$

The sag in our case,

$$D_1 = D\left(1 - \frac{K'h}{4 \times K \times D}\right)^2 = 43.8\left(1 - \frac{47.2}{4 \times 43.8}\right)^2 = 23.4,$$

which is the maximum sag in the whole year.

$$L_o = \frac{L}{2}\left(1 - \frac{47.2}{4 \times 43.8}\right) = \frac{1180}{2}\left(1 - \frac{47.2}{4 \times 43.8}\right) = 432.$$

The height of the lowest point above the sea level at the highest tide,

$$(157 + 48) - (47.2 + 23.4) = 134.4.$$

If the wind pressure be taken into account, the calculation becomes as follows:

Maximum temperature, 100 deg. Fahr. Wind pressure, 40 lb. per sq. ft.

$$K = 4.9. \qquad K_o = 1. \qquad t_o = -10. \qquad T_o = 15.$$

In the formula (6),

$$p = \frac{KmL}{80\,T} = \frac{4.9 \times 3.4 \times 1180}{80\,T} = \frac{245}{T}$$

$$p_o = \frac{K_o m L}{80\,T_o} = \frac{3.4 \times 1180}{80 \times 15} = 3.34$$

$$t - t_o = 100 - (-10) = 110$$

$$\left(\frac{K'}{K}\right)^2 - \left(\frac{K_o'}{K_o}\right)^2 = \left(\frac{1}{4.9}\right)^2 - (1)^2 = -0.06$$

The formula becomes,

$$\frac{60{,}025}{T^2} - 0.125\,T = 12.135.$$

From which we see T is approximately equal to 56.

$$\text{The safety factor} = \frac{150}{56} = 2.7.$$

The sag when the supports are at the same level,

$$D_1 = \frac{KmL^2}{8000\,T} = \frac{3.4 \times 1180^2 \times 4.9}{8000 \times 56} = 51.6.$$

The sag in our case,

$$D' = D\left(1 - \frac{K'h}{4\,KD}\right)^2 = 51.6\left(1 - \frac{47.2}{4.9 \times 4 \times 51.6}\right)^2 = 46.5$$

The vertical sag corresponding to D_1,

$$s_1 = \frac{46.5}{4.9} = 9.53.$$

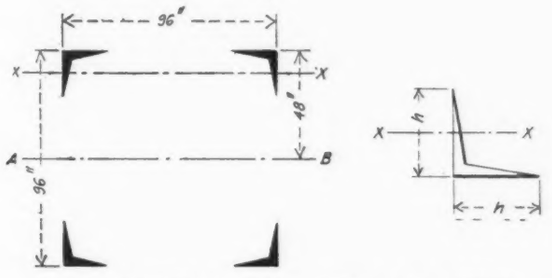


FIG. 3—SECTION THROUGH TOWER AND ANGLES

The inclination of the wire to the vertical plane is:

$$\text{Cos}\,\varphi = \frac{9.53}{51.6}$$

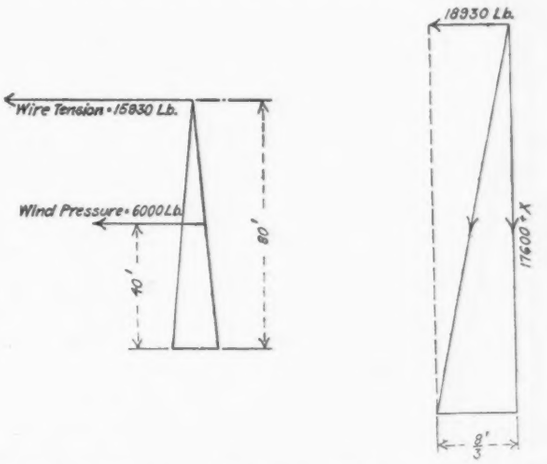
whence

$$\varphi = 79 \text{ deg. } 30 \text{ min.}$$

$$L_o = \frac{L}{2}\left(1 - \frac{K'h}{4 \times KD}\right) = 590\left(1 - \frac{47.2}{4 \times 4.9 \times 51.6}\right) = 563.$$

It is evident that maximum tension will occur during the lowest temperature in winter and maximum sag during the highest temperature in summer. In winter, the maximum permanent tension will be 15,000 lb., and the maximum momentary tension 60,000 lb. In summer, the maximum vertical sag will be 23.4 ft.

We shall calculate the strength of the steel tower under the worst condition; that is, when the wind pressure acts



FIGS. 4 AND 5—TENSION ON TOWER AND STABILITY DIAGRAM

on the tower with the same direction as the tension of the stretched wires. By the government's regulations the safety factor shall be more than three under these conditions.

Height of the tower, excepting the top arm, 80 ft.

Dimensions at bottom, 96 in. by 96 in.

Dimensions at top, 32 in. by 32 in.

Following are the sizes of angle steel used for the main corner members: Lowest part, 4 in. by 4 in. by 0.75 in.; middle part, 3.5 in. by 3.5 in. by 0.75 in. and 3.5 in. by 3.5 in. by 0.625 in.; upper part, 3.5 in. by 3.5 in. by 0.5 in. The total tension of the wire $3 \times 60{,}000 \times 0.0885 = 15{,}930$ lb. where 0.0885 sq. in. is the actual area of the stranded wires. This tension acts nearly horizontally at the top of the tower and the bending moment is

$$PL = 15{,}930 \times 80 \times 12 = 15{,}292{,}000 \text{ in.-lb.}$$

The wind pressure is about 6000 lb., which may be supposed to act on the middle point of the tower, and its bending moment is

$$6000 \times 40 \times 12 = 2{,}880{,}000 \text{ in.-lb.}$$

The total maximum bending moment at the lowest part of the tower is 18,170,000 in.-lb. But from the structure of the tower (Fig. 3) the moment of inertia of the angle-iron through the $X - X$ axis

$$= \frac{Ah^2}{10.2} = I,$$

and the moment of inertia of the structure through the $A - B$ axis,

$$I' = 4 \times [I + \text{area} \times (\text{distance between } XX \text{ and } AB)^2]$$

In our case, for the 4-in. by 4-in. by 0.75-in. angle,

$$I = \frac{Ah^2}{10.2} = \frac{5.44 \times 4^2}{10.2} = 8.12$$

For the structure,

$$I' = (8.12 + 5.44 \times 48^2) \times 4 = 50{,}032$$

But the relation between bending moment and the moment of inertia is

$$M = \frac{I}{n} f.$$

Where n is the distance of the extreme fiber from the neutral axis, f is the extreme fiber stress.

In our case the bending moment due to the wire tension and the wind pressure is

$$18{,}170{,}000 = \frac{I}{48} \times f.$$

Hence:

$$I = \frac{18{,}170{,}000}{f} \times 48,$$

which must be equal to the I'; that is:

$$\frac{18{,}170{,}000}{f} \times 48 = 50{,}032.$$

Whence

$$f = \frac{18{,}170{,}000}{50{,}032} \times 48 = 17{,}424 \text{ lb.}$$

Taking the ultimate tensile strength as 60,000 lb., the safety factor will be

$$= \frac{60{,}000}{17{,}424} = 3.4.$$

Thus the structure is well within the required safety limit.

To determine the weight of the foundation concrete, the weight of the tower being 8 tons, the total force at the top of the tower, from Fig. 4,

$$= 15{,}930 + 3000 = 18{,}930 \text{ lb.}$$

X = the weight of concrete.

Then, to get the stability of the tower, the point of application of the resultant force is to be within a third of the base from the vertical axis.

$$\frac{18{,}930}{17{,}600 + X} = \frac{\frac{8}{3}}{80}$$

$$\therefore 18{,}930 \times 80 = \frac{8}{3}(17{,}600 + X)$$

$$\therefore \frac{18{,}930 \times 80 \times 3}{8} - 17{,}600 = X$$

$$X = 557{,}900 \text{ lb.}$$

Submarine Transmission Line in the Baltic Sea

The recent contract of a large Swedish central-station company to furnish energy to a Danish electric power and railway company through a submarine cable laid in the Baltic Sea recalls the 12,000-volt, three-phase cable, 18,800 ft. in length, across the San Francisco Bay, which was noticed on page 1193 of our issue dated June 1, 1912, and the more recently completed Stralsund Channel project—the early high-tension submarine transmission systems of the world.

The two 15,000-volt, three-phase cables for the Stralsund Channel project were laid between the generating station at Stralsund and the island of Rügen for the purpose of supplying energy to the inhabitants of the island of Rügen and also with the view of extending the system across the island to the peninsula of Wittow.

In crossing the straits between the island of Rügen and the mainland the cables were laid across the small island of Dänholm in order that electric service might be furnished on this island. The distance from the mainland to Dänholm was 1100 ft. and from Dänholm to the island of Rügen the distance was 4500 ft. In order to facilitate the process of manufacture and to reduce the cost of transportation, the cable for the 4500-ft. span was made in two sections, one of which was 2500 ft. and the other 2000 ft. in length. The largest reels were 9.75 ft. in diameter and 6 ft. wide and weighed 42,000 lb.

A steamer and three scows were chartered to lay the cable. Two of the scows were fastened together by means of I-beams and chains and the cable reels were set up in bearings on the decks of these scows. It was thought best not to use the ship's engines for propelling the scows while the cable was being laid, as it would have been impossible to control the motion of the barges with sufficient precision. Accordingly, all movement of the barges while paying out cable was accomplished by means of steam winches acting upon anchors which had previously been sunk in the line of travel. Side anchors were used to prevent drifting. When the end of the 2500-ft. cable was reached the third scow was anchored and the end of the

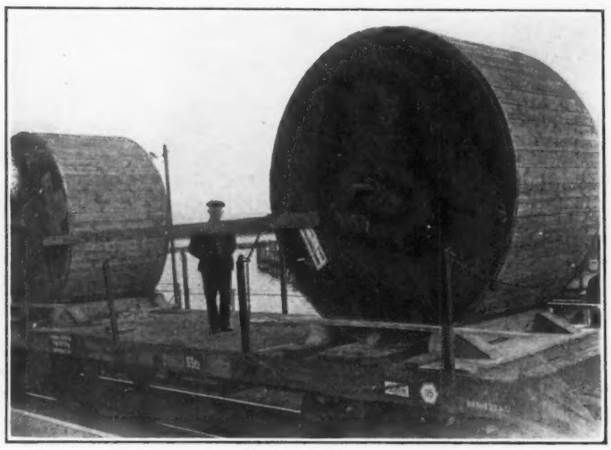


FIG. 1—CABLE DRUMS IN TRANSIT

cable lashed to its deck. The 2000-ft. length of cable was then laid from the anchored scow to the island. A weatherproof tent, erected over the end of the cables and electrically lighted from the ship's generating equipment, furnished a place for the workmen to splice the cables in spite of the inclement weather.

It is a notable fact that this was the first time submarine high-tension cables have been spliced at sea. The cable connections were soldered and saturated with insulating compound, after which the compound was allowed to cool for several hours. Iron sleeves were used as armor, and they, too, were filled with insulating compound and were sealed. When the splices had been made they were lowered over the side of the barges by means of ropes and

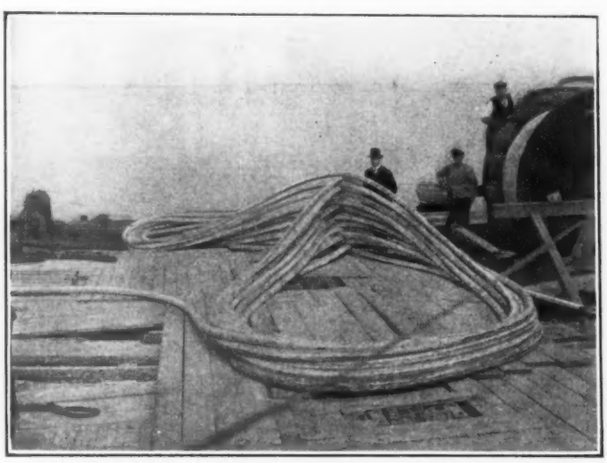


FIG. 2—ARRANGEMENT OF CABLE ON DECK

windlasses into the water, which was at that place about 30 ft. deep.

One of the accompanying illustrations shows a huge pile of cable laid on the decks of the scows in the form of a figure eight. As it was impossible for the scows to approach closer than within 200 yd. of the shore, this means was resorted to in order that the end of the cable might be reached and taken upon the shores of the island. It is

stated that the services of twenty men were required to pile the cable in the shape in which it is here shown. Near the shore and in places where the water was shallow the cable was laid in trenches 3 ft. deep which had been dredged for the purpose.

In laying the two cables to the peninsula of Wittow a different method was adopted. The reels were set up on the shore and a steel hawser was strung across the strait, over

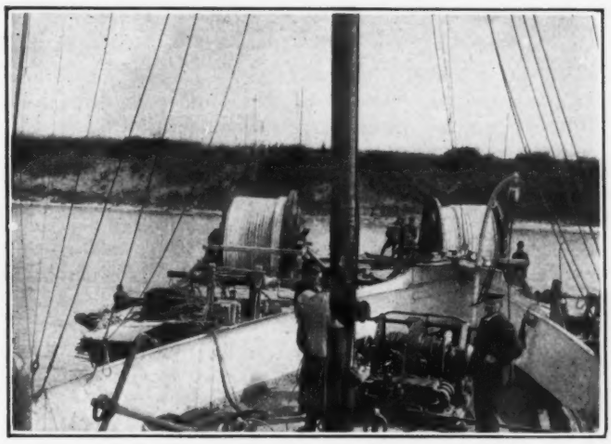


FIG. 3—ARRANGEMENT OF CABLE REELS

a pulley on the bank opposite the reels, and out again to the steamer on the water. By connecting the hawser to a steam winch the cables were dragged across the intervening water with the assistance of small boats placed 75 ft. apart to keep them off the muddy bottom of the sea. This method obstructed all traffic in the channel and during the night search-lamps were employed to illuminate the small boats and to warn other vessels that the passage was temporarily closed. The channel at this point is about 1500 ft. wide.

Another instance of submarine energy transmission is that across the Straits of Fehmarn. A large section of Holstein is supplied with energy from the generating station at the Siemens factory. Use is made of two lead-covered, iron-wire-armored, paper-insulated 11,000-volt cables, 3 by 2.5

FIG. 4—SPLICING THE CABLES

sq. mm in cross-section, to connect the island of Fehmarn with the Siemens system. Overhead lines lead from the central station at Goehl to a cable-terminal station at the shore. From this place the cables extend a distance of 3300 ft. across the sound to a second cable-terminal station from which overhead lines distribute energy over the island.

Each cable was arranged in two sections each mounted on a drum, weighing with its cable about 20 tons. They were laid by means of cable boats moved by winches to pay out the cable when near the shore. In mid-stream the cable ships were towed by a steamer which proceeded at a speed of about 100 ft. per minute. The two ends of the cable thus laid out were fixed on the boat and a tent was erected for making connections between them and the other cable ends

60,000-Volt Steel-Tower Line Construction in Southern California

BY HARRY W. DENNIS

In the spring of 1912 construction was started on a steel-tower line for the transmission of electricity at 60,000 volts between certain of the main stations of the Southern California Edison Company. This company operates extensively in southern California and has a transmission system as shown on the accompanying map. A brief synopsis descriptive of the system of the company will explain the reasons for the new tower-line construction and will be of assistance in following the description of the new work.

PLANTS AND TRANSMISSION LINES

The transmission system interconnects all of the generating plants and substations and leads, naturally, to three primary centers of distribution, Los Angeles, Colton and Santa Ana. The generating plants comprise both hydraulic and steam power and include the following stations:

	Kw.
Hydroelectric:	
Kern River No. 1	20,000
Santa Ana River No. 1	3,000
Santa Ana River No. 2	1,000
Mill Creek No. 1	750
Mill Creek Nos. 2 and 3	3,250
Lytle Creek	500
Steam:	
Redlands	600
Los Angeles No. 3	10,000
Long Beach (including No. 3 unit now in course of construction)	47,000
Total	86,100

The hydraulic stations, with the exception of Kern River plant No. 1, are relatively close to Redlands and, taken with the Redlands steam plant, may be considered as one unit of the generating system, with a principal receiving substation in the city of Colton. This Colton group is widely separated from the other generating stations, although there is now a steel-tower line connecting the Colton substation with Los Angeles No. 3, Long Beach and Kern River. The transmission line between Kern River No. 1 and Los Angeles, a distance of approximately 118 miles, was built in 1907 and consists of a single line of steel towers carrying two circuits of No. 0000 stranded copper cable supported on pin-type insulators.

The original transmission line between Colton and Los Angeles was constructed in 1897 and consisted of two circuits of No. 1 copper wire supported by wooden poles. In the latter part of 1909 it became obvious that it would soon be necessary to arrange for replacing this wooden-pole line, both because the wooden poles were rapidly giving out and because the wire was too small for the requirements of the load which it was called upon to transmit. It is a matter of interest to note that this wooden-pole line was constructed for the primary purpose of transmitting hydraulic power of the Colton group of stations to Los Angeles for market, and that the load in the vicinity of Colton had reached such proportions that not only did it require all of the generating capacity of the Colton group but it was also necessary to transmit power from Los Angeles. The original line operated at 30,000 volts, and it was determined to plan the new line for 60,000 volts, with long spans supported by steel towers and suspension insulators.

About this time, also, it became necessary for the Southern California Edison Company to provide for additional generating equipment, and the construction of the steam plant at Long Beach was started, unit No. 1 of this plant being put in operation in August, 1911.

Provisions for Towers

The towers which were erected in 1907 for the Kern

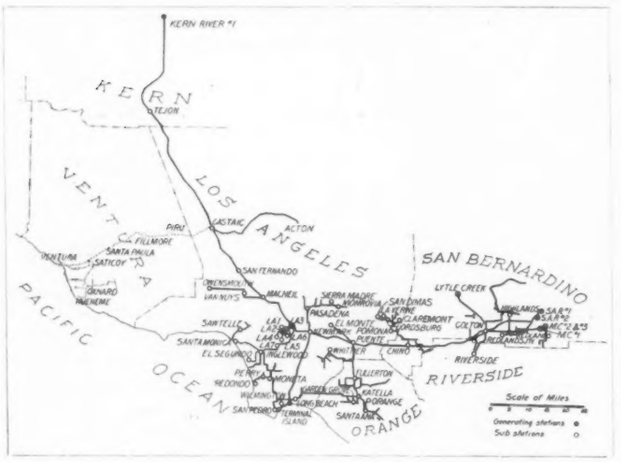


FIG. 1—MAP SHOWING LOCATION OF TRANSMISSION LINES

River line were intended for three circuits, being arranged to support five wires on the upper cross-arm and four wires on the lower arm, the three wires of each circuit forming an equilateral triangle. For the new line a similar tower was designed. Competitive bids were secured, however, as a result of which a tower was chosen to carry two circuits, the wires for both being arranged in a plane nearly vertical and supported at the ends of the cross-arms. On account of right-of-way restrictions, it was determined that the towers should be made self-supporting without placing any reliance upon the use of side guys. Accordingly several sizes of towers were adopted, all, however, conforming to the same general design, the heavier towers being made up of heavier sections and being so designed as to provide for a range in angles. The standard tower was intended for use only on straight-line work and deflection angles not exceeding 1 deg. There were eight special towers of the same height as the standard tower but designed for angles so as to cover the whole range of deflection up to a full right angle. It also became necessary to have three other special towers conforming to the general design, but made higher to give the necessary clearance in certain special cases. The accompanying illustrations show the design of these towers, and the table gives the deflection angles, approximate weights and sizes of members.

The climatic conditions obtaining in southern California made it unnecessary to consider any ice or sleet load upon the wires, and the controlling elements of the design, therefore, were:

(1) Range of temperature, from 20 deg. Fahr. to 110 deg. Fahr.

(2) Wind, for which the possibility was considered of an actual velocity of 60 miles per hour occurring at 40 deg. Fahr.

(3) One broken wire.

(4) Maximum strain in stranded copper cable, 22,000 lb. per sq. in.

(5) Maximum tension in steel, 30,000 lb. per sq. in.

(6) Maximum compression for tower legs according to the following formula,

$$p = \frac{21{,}500}{1 + \frac{l^2}{36{,}000\, r^2}}$$

in which p is allowable compression in pounds per square inch, l is unsupported length in inches, and r is least radius of gyration in inches, the ratio $\frac{l}{r}$ being limited to 150.

(7) The holding-down effect of earth taken at 45 lb. per cu. ft., including the weight of the frustum of a cone, the angle of whose sides with the vertical is 45 deg. This requirement is equivalent to a factor of safety of two, with 90 lb. per cu. ft. for actual weight of earth.

Steel-Tower Location and Right-of-Way

The towers were purchased from the Riter-Conley Manufacturing Company under specification which required a shop load test for the standard towers. All members were required to be hot-galvanized and all bolts to be sherardized. The height of the towers was determined by consideration of minimum clearance of 33 ft. above the surface of the ground and 8 ft. between cables, and the tower locations were adopted in accordance with a standard spacing of 700 ft., the variation in this spacing being made where towers were located on ridges permitting ample sag, and the maximum spacing between any two towers as erected was 1874 ft. The line was located upon a private right-of-way for the entire distance of approximately 75 miles, with the exception of a distance of 1.94 miles upon the streets of the city of Los Angeles, and although the tower as described was used for the major portion of the line, it was necessary to adopt a smaller structure for certain pieces of right-of-way.

For a distance of 7 miles the line is located through valuable ranch property, where it became necessary to con-

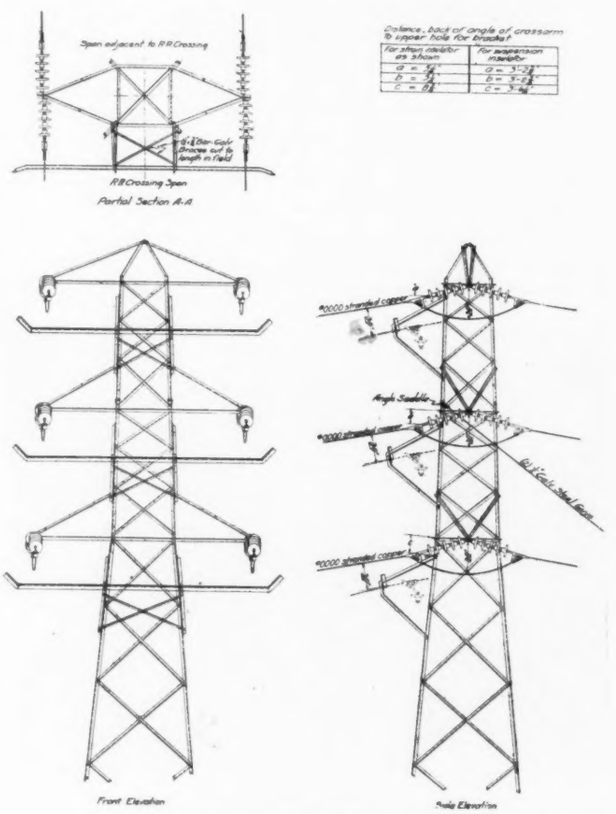


FIG. 2—DETAILS OF TOWER TOP

struct a pole not more than 3 ft. square, and this pole was erected, requiring a standard spacing of 660 ft.

In the city streets of Los Angeles still another design was made necessary, where the supporting structures were required to provide 45 ft. clearance under the line and a maximum dimension of 18 in. square at the ground. For this part of the line most of the spans are about 200 ft.

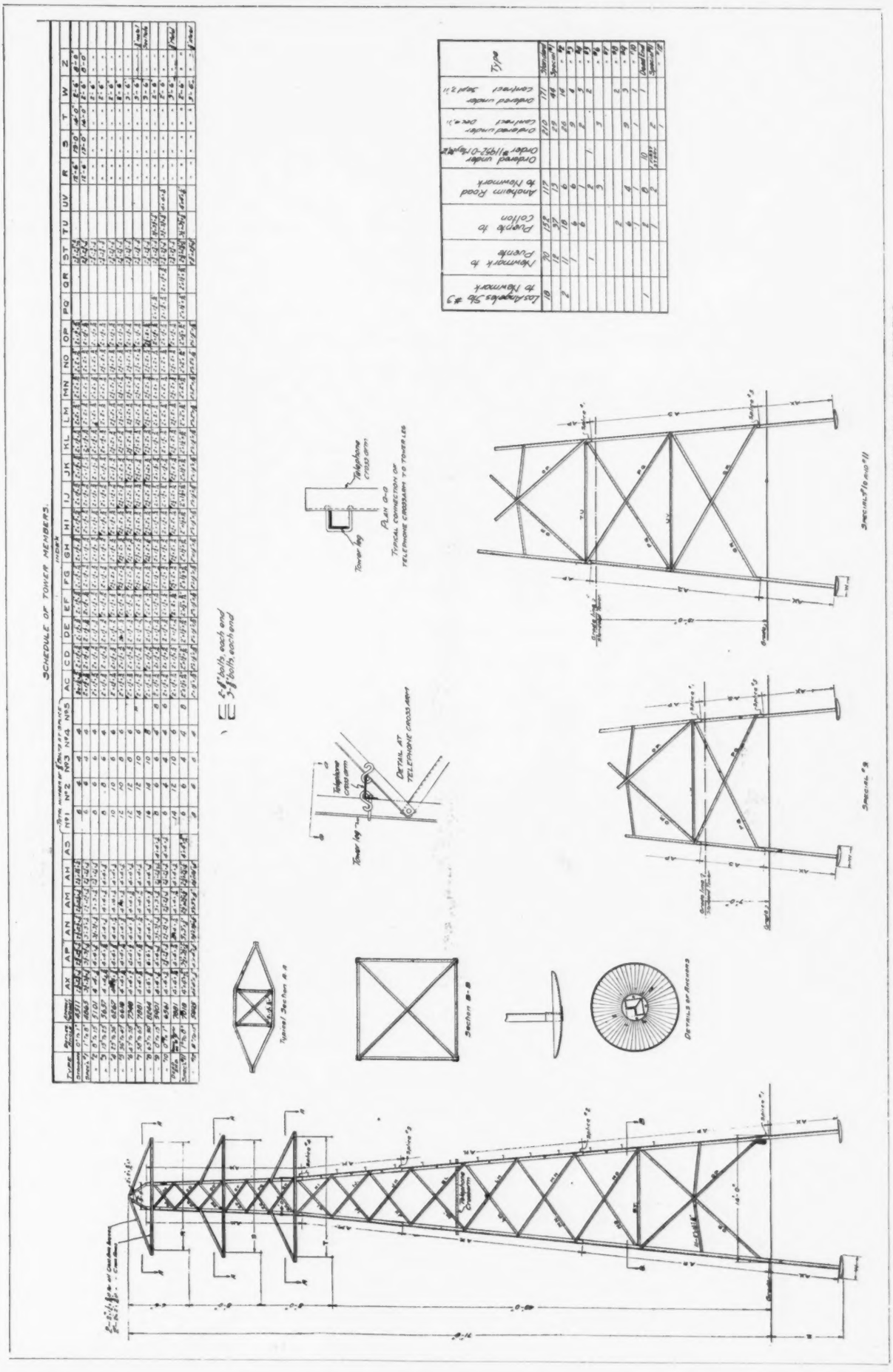


FIG. 3—DESIGN DETAILS OF TOWER STRUCTURE, SHOWING WEIGHTS AND DIMENSIONS OF ALL MEMBERS

Reference to the construction drawings shows that each footing of the towers consists of a single angle bolted to a dished plate 2 ft. 6 in. in diameter, excepting for some of the special towers and for the dead-end, for which the disk is 3 ft. 6 in. in diameter. Concrete was used in this footing only to provide uniform bearing under the disk, and at the crossings of railroads, where the requirement was made that the angles should be incased in concrete up to the ground line so as to prevent rusting. Although due consideration was given to the matter of preparing concrete foundations to a point above the ground line, cost made this prohibitive, owing largely to the fact that much of the line was built through desert country where it would have been necessary to haul materials and water a long distance in order to prepare such concrete footings. The company's previous experience on the Kern River towers, where no concrete was used, had also been such as to warrant the repetition of the same kind of construction.

For the steel poles having bases 36 in. square a spread concrete footing was prepared, although for the steel poles whose base was 18 in. square the character of the soil was such as to render a spread footing unnecessary, and the back-fill only was made of concrete.

Suspension-Type Insulators

Suspension-type insulators are used throughout on this transmission line, those chosen being of the Locke No. 2565 10-in. type. Although these insulators were purchased under specifications which required successfully withstanding tests of 90,000 volts, four units in series are used at all supporting points other than points where strain in the direction of the line occurs, at which points five units in series are installed. The wisdom of providing one extra unit at strain points is apparent when consideration is given to the difficulty involved in replacing one of these strain untis. By having the extra insulator one unit may fail electrically without causing a shut-down of the line and the tedious operation of replacing the broken unit.

Dead-end construction is used at all angle points where the deflection is more than 1 deg., and the cable is placed, without splicing, in a loop so as to give a clearance of 30 in. from the tower structure. This type of construction is also adopted at crossings of steam railroads in accordance with the railroad companies' specification that the conductor should be dead-ended at the tower on each side of the crossing span.

The railroad specifications also require that suitable grounding arms be erected under the wires so that in the event of mechanical failure of the insulator the live transmission conductor would not fall on to the railroad tracks.

Fig. 2 shows the grounding brackets and the method of dead-end construction.

Setting Stubs for Towers

The setting of the stubs for the towers is one of the distinct operations carried on by a separate squad of men, independent of the gang engaged in other operations incidental to the construction of the steel-tower line. In order to accomplish this work satisfactorily the essential elements are: Securing proper back-fill under and around the stubs and, in fact, filling the entire hole up to the surface of the ground, and the assurance that when this back-fill is complete the bolt holes through which the tower legs are secured to the stubs will be at proper elevation and location to conform to the shape of the base of the assembled tower. In the first towers which were erected on the lines here described there was a considerable amount of time lost owing to the failure to secure these objects, and as a result of subsequent experience the following procedure was adopted:

It being apparent that the original soil would be disturbed for at least a short distance under the stubs, and that difficulty would exist in securing compact back-fill of

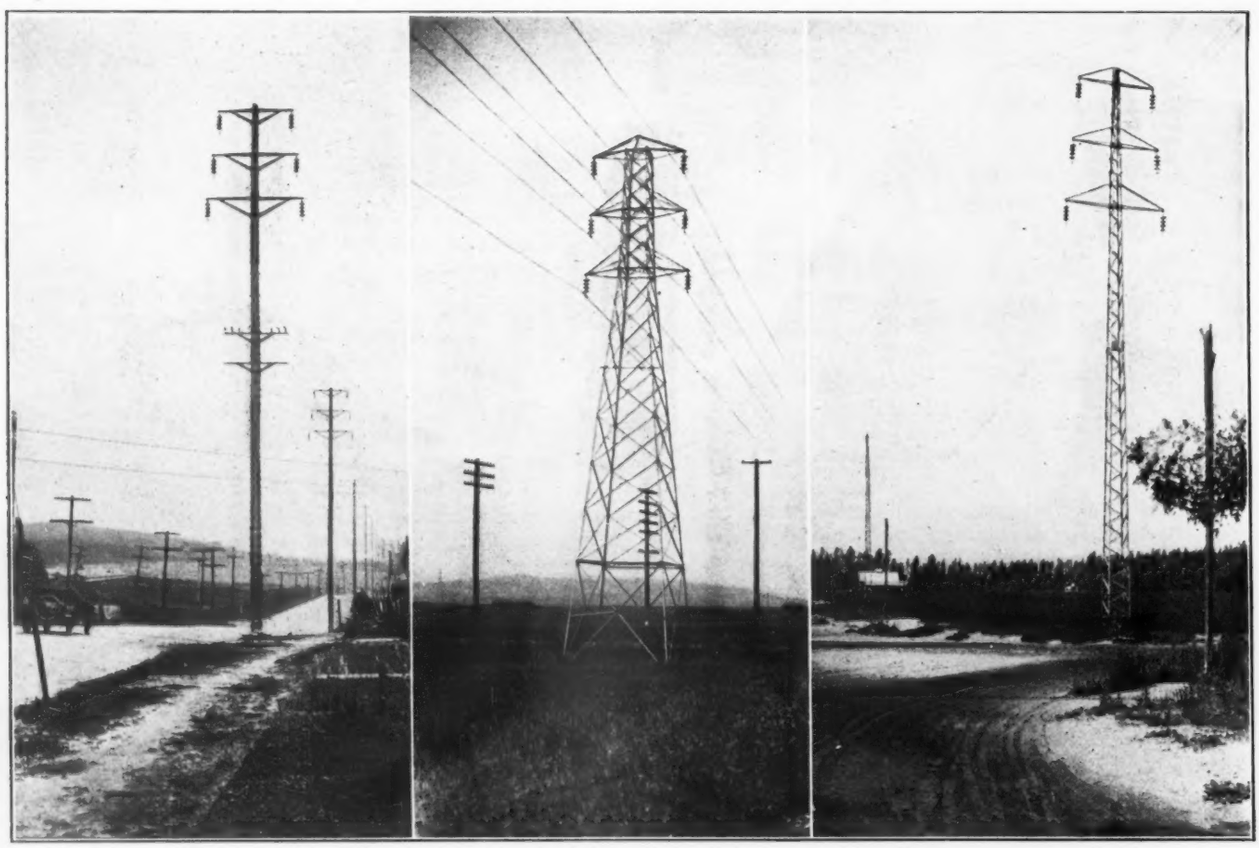


FIG. 4, 5 AND 6—VIEWS ALONG THE TRANSMISSION LINE, SHOWING MINIMUM, STANDARD AND MEDIUM WIDTH TOWERS

earth under the disks, concrete was used for the back-fill under the anchor plates. This concrete was in general carried only up to the top of the anchor plate, and the remainder of the hole was filled with excavated material. At angle towers, however, the entire hole for about 18 in. above the disk was filled with concrete, the bottom of the hole having been enlarged so that it would be impossible for the tension stubs to pull out except by lifting the adjacent earth. In order to secure the proper final position of the bolt holes, there was used a wooden templet in connection with nine stakes, one at the center of the tower and two adjacent to each hole. The templet chosen consisted of a piece of 2-in. by 4-in. lumber, at one end of which was securely fastened a piece of 2-in. by 2-in. at the proper bevel, so that when the main member of the templet was horizontal and one end correctly located at the center of the tower, the other member of the templet was in a position to lie inside of the angle which formed the tower stub. The templet accordingly rested upon the center stake and one of the above-mentioned stakes near the hole for the leg, which, of course, was so set as to give the proper direction for the templet relative to the tower base. The other stake to which reference has been made was placed wtihin 24 in. of the location of the stub, so as to be within reach of a carpenter's level, and with the combined use of the templet and this level the stub could be properly located to conform to the foregoing requirements. On certain side-hill work it was necessary to do some trenching, so that the templet could be conveniently used, but the expense of such extra excavation was considered preferable to arranging for special tower members which would conform with the actual ground conditions.

On account of the improper setting of some of the tower stubs and the failure of the sub-foreman to appreciate the necessity for extreme accuracy, an experiment was made by using another type of templet upon which two stubs, diagonally opposite one from the other, could be suspended, in the hope that this method would secure the desired result without the extreme care made necessary by the method above described. In the construction work, however, it was found that this templet was too long and bulky to be handled readily and transported between towers and that it lacked sufficient rigidity. To overcome this would have required that it be made heavier and more unwieldy, and accordingly the original method was adopted for the remainder of the work.

Assembling and Erecting Towers

The assembling of the towers was carried on by a crew of eight men and a sub-foreman. Except in special cases, the towers were erected on the ground so that the vertical axis of the tower lay in the direction of the line. The tower material was spread out on the ground in the proper position, so that after the members forming the two sides were fully bolted together they were tipped up into vertical position and held, while certain of the cross-members of the other sides were securely fastened to the leg members. After the tower was fully assembled, all of the bolts were tightened, but the final tightening was deferred until after the tower was erected. In special cases it became necessary to assemble the tower in places where local conditions were such that a large amount of benching would have been required for assembling the tower on the ground, or where other conditions made the usual procedure impossible.

The erection of the towers was accomplished by a gang of eight men and a foreman and one team, the process being shown in the accompanying illustration. A sling was fastened to the tower at the lower cross-arm and carried over a gin-pole to a set of blocks, one end of which was in turn anchored to a dead-man buried in the ground about 70 ft. from the base of the gin-pole. Fastened to the foot of the tower, at the holes provided for the splice between tower legs and the stubs, there was temporarily secured a 6-in. wrought-iron pipe, each end of which was securely snubbed back by chains to three long steel pins driven in the ground. Temporary struts were used between the ends of adjacent tower legs. The pipe also served as a convenience in securing the lower end of the gin-pole. Side guys for the gin-pole were of course provided, these guys being snubbed to pins driven into the ground, care being taken that the guys were directly opposite and at right angles to the axis of the tower. No side guys were provided for the tower itself, inasmuch as the width of the base is approximately 14 ft. and the pipe was securely supported at either end. A back guy for the tower was, however, provided. The gin-pole is at all times at right angles to the axis of the tower, so that when the tower reaches the vertical position the gin-pole is upon the ground.

Under the ends of the pipe planks were provided so that the tower may be conveniently pinched in any direction to bring the holes in the legs of the tower fair with the holes in the stubs, and after two of the legs are bolted an additional strain is taken in the hoisting line, so that the legs carrying the pipe are somewhat elevated and the pipe itself is removed, whereupon the tower can be slacked back and the two connections made. Although the actual operation of raising the tower from the time the upper cross-arm left the ground until the tower stood in a vertical position was usually accomplished in a very short time, the time involved in the operations of digging holes for dead-men, arranging slings and pipe, placing gin-pole, hoisting line and back guys, bolting tower legs to stubs, assembling, loading and transporting equipment to the next tower, amounted to something over an hour. The best day's work accomplished by the tower-erecting crew consisted in the complete erection of ten towers in an eight-hour working day.

After the towers were fully erected and before any strain was brought upon them by stringing wire, a separate crew of men tightened all of the bolts so as to develop as much pressure as possible between adjacent tower members, and in order to prevent a subsequent loosening of the bolts by vibration or other agencies, each bolt was "center-punched" so as to injure the thread of both the bolt and the nut.

Preparation for Stringing Wire

The wire used on this transmission line was No. 0000 copper cable, having seven strands. It was furnished in reels, each having a total weight of approximately 2000 lb. and containing nominal lengths of one-half mile per reel. The cable was delivered to the company at various convenient railroad sidings, from which points it was distributed along the line. For unreeling the wire the method first employed involved using a heavy wagon having specially constructed framework with provision for hoisting three reels and slinging these on steel rollers through the centers of the reels, the end of each wire being spliced to the wire already strung out. The wagon was then taken along the line, unreeling the wire between the towers. This method was possible because all of the wires were supported at points outside of the frame of the tower, but it was subsequently abandoned on account of the facts (1) that in various locations the ground was so rough that hauling the wire in this way was impracticable, (2) that part of the towers were erected parallel to property fences, so that there was insufficient room to haul the wagon between these fences and the towers, and (3) that it became necessary to take down whatever fences were crossed by the line to allow the wagon to pull through.

The principal advantage in this method of unreeling the wire lies in the fact that the wire was not dragged over the ground, although it must be borne in mind that where the ground conditions were such as would harm the wire they were in general so rough as to make it impossible to use this method at all. The method finally adopted as being more flexible and suitable for all occasions was that of supporting the reels on standards and dragging one or more wires into position.

As mentioned, the insulators were 10 in. in diameter and were manufactured by the Locke Insulator Manufacturing Company. They were bought subject to test and acceptance at the company's test department at Los Angeles. As there were no means of testing these units after leaving the company's warehouse, special precautions were adopted to transport them safely from the warehouse to the site of the work. This transportation was accomplished by means of an automobile truck, and special crates were built to eliminate as far as possible any accident to the insulators after leaving the test. For the standard towers there were required four for each point of support, a total of twenty-four units. The crates were built accordingly, each crate providing for three strings of four units each, to be supported top and bottom, and to be clear so that the porcelain would not be in contact with any part of the crate. It was the intention to leave these insulators in the crates until the linemen could swing them into position on the towers, but for certain reasons the method was given up and the insulators, after being tested, were again packed in the original crates for shipment to the work, it having been found that irregularity in construction progress coupled with the extremely long haul—in some instances nearly 60 miles—made it impossible to supply the insulators in proper time for construction, and that the method of supporting the insulators in the new crates subjected them to severe mechanical strain, involving in many instances loosening of the hardware of the insulator units.

To hang the wire to the insulators involved the use of the ordinary suspension-type hardware with a malleable-iron clevis furnished with the insulators. To hang the insulators from the cross-arms there was used a forged clevis having an opening corresponding to the combined thickness of gusset plate and down-standing legs of the tower cross-arms. By this means a universal joint was secured so that any string of insulators might move in a direction either longitudinal or transverse with the line. For the dead-end construction at all angles where the deflection was more than 1 deg., as well as at railroad crossings, there was used the Locke No. 2383 dead-end hardware, together with a string of five insulator units fastened by means of a forged clevis to an eye-bolt carried through a hole in the down-standing legs of the tower cross-arm.

After the insulators with their hardware were hung in their proper position on the tower, the wire was strung through snatch blocks hung by chains as nearly as possible at the proper elevation, so that no further lifting of the wire would be required when proper tension had been secured. Everything was then in readiness to transfer the wire to the insulators.

Pulling the Wire to Tension

Although there were numerous angles in the right-of-way for the line here described, practical conditions made it possible to pull to tension at one operation, even on straight-line work, more than seven spans of wire, representing a distance of approximately 4900 ft., it being found by experiment that even with this number of spans there was sufficient loss in tension at each snatch-block support to give a very large difference in sag in the first span as compared with the last. Accordingly the center span was observed in determining the proper sag for any one pull. The major part of the slack was pulled by the team and a final adjustment made by the use of blocks. A special come-along was adopted consisting of two pieces of wrought iron in which grooves of suitable size had been machined. To one of these was forged an eye of ample size, and the two pieces were bolted together over the wire by the use of four cap screws. The length of the bearing secured upon the wire was approximately 6 in., which was found to be ample to develop sufficient friction for making the required pull without slipping or injuring the wire. The grooves in this come-along were rounded on all edges and the cap screws were of such size that the heads would fit the flat wrenches carried by the linemen for making up the insulator hardware, thereby reducing to a minimum the necessary tools required for the working outfit.

Although the proper tension in the wire was for a time determined by the use of dynamometers, this method was subsequently abandoned in favor of the sag method, and the curves representing the proper sag for various conditions of temperature and span were for convenience on the part of the inspectors reduced to the accompanying table.

In the use of the table the temperature taken must be that in the air itself, on account of the variation due to even slight elevations above the ground. This is emphasized by a set of observations taken as follows:

Time—10:40 a. m.

Location—Long Beach line about 3 miles from the ocean.

Temperature at elevation 45 ft. above the ground—75 deg. Fahr.

Temperature 4 ft. above the ground—80 deg. Fahr.

Temperature with thermometer lying on ground (clean, dry sand)—116 deg. Fahr.

Temperature with thermometer lying on ground with bulb covered with sand—127 deg. Fahr.

TABLE OF PROPER SAG, DEPENDENT UPON TEMPERATURE AND SPAN

(No. 0000 copper cable; maximum working stress, 22,000 lb. per sq. in.; controlling conditions, 20 deg. Fahr. and no wind, or 40 deg. and 60-mile wind.)

Span, Ft.	20 DEG. FAHR.		40 DEG. FAHR.		60 DEG. FAHR.		80 DEG. FAHR.		100 DEG. FAHR.		120 DEG. FAHR.	
	Sag, Ft.	Stress, Lb.	Sag, Ft.	Stress, Lb.	Sag, Ft.	Stress, Lb.	Sag, Ft.	Stress, Lb.	Sag, Ft.	Stress, Lb.	Sag, Ft.	Stress, Lb.
200	0.85	3655	1.00	3185	1.15	2740	1.37	2325	1.65	1960	1.95	1650
250	1.35	3655	1.60	3215	1.80	2795	2.10	2410	2.44	2075	2.80	1770
300	1.97	3655	2.25	3245	2.55	2850	2.93	2490	3.33	2185	3.77	1925
350	2.70	3655	3.03	3270	3.40	2900	3.85	2565	4.30	2285	4.83	2050
400	3.55	3655	3.95	3295	4.35	2950	4.85	2640	5.42	2380	6.97	2160
450	4.47	3655	4.93	3315	5.47	2990	6.00	2710	6.60	2465	7.23	2260
500	5.52	3655	6.05	3335	6.65	3035	7.25	2770	7.90	2545	8.56	2350
550	6.70	3655	7.27	3350	7.95	3070	8.60	2830	9.30	2620	10.00	2430
600	7.95	3655	8.62	3365	9.35	3110	10.05	2890	10.80	2690	11.55	2510
650	9.35	3635	10.10	3370	10.80	3135	11.60	2920	12.40	2740	13.20	2575
700	11.05	3580	11.85	3335	12.65	3120	13.45	2930	14.30	2765	15.15	2610
750	12.80	3535	13.65	3310	14.55	3120	15.40	2940	16.25	2785	17.10	2645
800	14.75	3500	15.65	3295	16.65	3115	17.50	2950	18.45	2810	19.25	2680
850	16.75	3465	17.70	3270	18.70	3115	19.60	2965	20.50	2830	21.50	2710
900	18.95	3440	19.95	3260	20.95	3115	21.95	2975	22.90	2850	23.85	2735
950	21.25	3415	22.25	3255	23.25	3110	24.30	2990	25.30	2865	26.30	2760
1000	23.80	3395	24.85	3240	25.90	3110	26.90	3000	27.95	2885	28.95	2785
1050	26.30	3375	27.45	3230	28.50	3110	29.55	3010	30.60	2900	31.65	2810
1100	29.05	3355	30.15	3220	31.25	3110	32.25	3020	33.40	2915	34.50	2830
1150	31.90	3340	33.05	3215	34.20	3110	35.30	3025	36.40	2930	37.50	2845
1200	34.95	3325	36.10	3210	37.25	3110	38.35	3030	39.50	2940	40.60	2860
1300	41.20	3310	42.30	3210	43.50	3120	44.70	3050	45.80	2960	46.90	2900

Where straight-line construction occurred for more than seven spans temporary dead-end connection was made by carrying the cables to the basket of the tower and securing them by chains and come-alongs, and when the proper tension had been taken in the spans ahead the strain in the chains would be relieved, and they could readily be removed and the wire transferred into the suspension hardware.

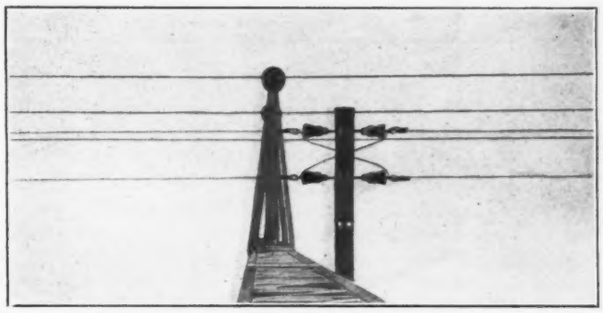


FIG. 7—"WORM'S-EYE" VIEW OF TOWER

On account of the fact that the standard towers were designed for the unbalanced pull of only one wire, and the further fact that even with this unbalanced pull there was a slight deflection of the tower, head guys were used to take up the strain. Whenever on angle towers the strain was finally imposed, the wires on opposite ends of the same cross-arm were slacked off simultaneously to avoid any possible twist in the tower. Wherever permanent dead-end construction was used, the cable of course was pulled past the tower, and after having been made up the wire ahead was pulled back by the use of blocks so as to give the requisite loop under the dead-end insulators. By this method no splicing was required.

In the operation of making up the dead-end clamp in its proper position a gage was used corresponding in length to the combined lengths of clevis, insulators and dead-end shoe, thereby assuring the proper location of the dead-end clamp. The wire was then pulled above tension a sufficient amount to allow for slack in the insulator units, which was required owing to the weight of the insulators and the necessarily awkward position which the lineman must adopt in holding the insulator. After the shoe had been made up and the insulators placed, the wire was slacked off by hand, the necessary amount of wire in the loop measured and the opposite shoe located and hung to the cross-arm, whereupon the wire in the next span was pulled as before.

In certain special cases it became necessary to make a splice in the loop at the tower, and in all these instances the strands were separated and interlocked with the strands of the other section and fully served out.

As has been mentioned, dead-end construction was required by the specifications of the railroad lines where transmission-line crossings were made necessary, and the tower itself was required to be self-supporting under conditions of broken wires on spans adjacent to the railroad. At certain of these crossings dead-end towers were used and at other crossings standard towers with back guys, this latter construction having been chosen wherever right-of-way restrictions did not prohibit the use of such guys. At one of these crossings, where a short span was made necessary, it was found that the deflection of the towers was such that the tension in the crossing span exceeded that in the adjacent spans due to the tension of the back guys. On account of change in temperature, the tension developed in this short span became sufficient to rupture mechanically one of the strain insulators, and as a remedy for this condition the following construction was adopted:

Guy cables were strung between the baskets of the towers on opposite sides of the railroad and drawn to such tension as to take all of the strain of the opposing back guys, and in addition thereto some of the strain of the transmission wires in the adjacent spans, whereupon the tension in the crossing span was reduced to such a point as to eliminate the possibility of further trouble.

TELEPHONE SYSTEM

The Southern California Edison Company, in line with the practice of most operating companies, has its own private telephone line interconnecting all of the generating stations and the principal substations. Although the telephone line is primarily intended for use in operating the system, for which use it would fulfil its purpose in any location, it must be remembered that there are long stretches of the transmission line here described which are not adjacent to any public highway, and accordingly it was decided to erect the telephone upon the same towers with the transmission line, so that the patrolmen could readily report the location of trouble and likewise report clearance promptly after the trouble had been remedied. In general, one telephone pole is used in each span, it being the intention to limit the length of telephone spans to 350 ft. There were many spans, however, wherein it was impracticable to locate this intermediate pole, and the telephone wire was required to make the same span as the transmission cables. The wire adopted for the telephone system was No. 6 B. & S. gage Phono-electric wire, and in order to minimize the induction on the line a telephone transposition was made at every tower. Dead-end construction was adopted for the towers, using Thomas suspension insulator No. 1074, with 4-in. petticoat.

The insulator is secured to the steel cross-arm by the use of an "S" hook. The Phono-electric wire is made up by the use of a special two-bolt cast-iron clamp, a thimble being used where the wire hooks to the insulator. Weather-proof wire is used for the transposition, and the joint between the Phono-electric wire and the weather-proof copper wire is soldered. The plate shows the construction as adopted on one of the steel poles, but the same details were followed on the towers, a single cross-arm being used on straight-line towers and sight deflection angles, and two cross-arms, one on either face of the tower, being used where angles were so great as to cause interference with the cross-bracing of the tower. For that part of the line between the Los Angeles No. 3 station and the Newmark substation there are three telephone circuits; between the Newmarq and Colton substations there are two, and between Newmark substation and the Long Beach steam plant there is one circuit.

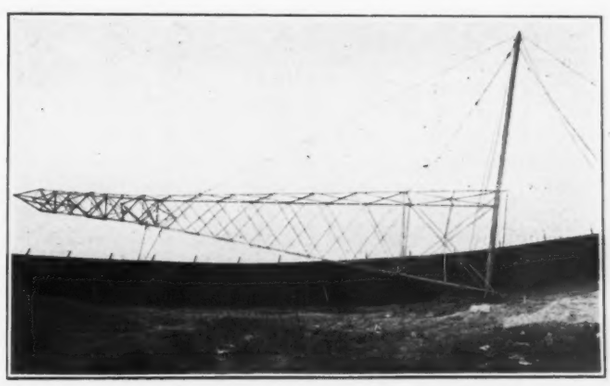


FIG. 8—METHOD OF LIFTING TOWER IN PLACE

The officers of the Southern California Edison Company, for which the work here described was carried out, are Mr. John B. Miller, president; Mr. W. A. Brackenridge, vice-president and general manager, and Mr. R. H. Ballard, secretary and assistant general manager. The work was done under the personal supervision of the writer as construction engineer for the above company.

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Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Billboard Advertising in Toronto

The accompanying illustration shows one of twenty similar billboards used by the Toronto Electric Light Company, Ltd., in advertising electric fans. The design, which was produced by the company's publicity department, is a composite effect derived from the cover design of two fan catalogs issued by the Westinghouse Electric & Manufacturing Company. The object sought was to produce a sign which at first glance would impress the observer with a sense of coolness, and without doubt this object has been achieved in the present instance. The artists who executed the design were very successful in getting the wave effect, which with the blue-sky background sets off the rest of the sign very effectively. The electric fan, which is painted in its true colors, is of such size as to be visible at a considerable distance from the billboard.

ELECTRIC FAN TIME IS HERE!
½ CENT AN HOUR KEEPS YOU COOL!
TORONTO ELECTRIC LIGHT CO. LIMITED
"At Your Service" 12 Adelaide Street East.

A "FAN-TIME" BILLBOARD

Electrical Refrigeration Used for Tempering Steel

Although the applications of electricity in steel making are numerous, the use of electrical energy in connection with the tempering of steel is not so widely known. The Pauly Jail Building Company, of St. Louis, which manufactures steel bars, gratings and jail equipment in general, employs an electrically driven refrigerating plant for keeping at a uniform temperature the water used for tempering steel. Since the installation of this system the output has both increased in quantity and improved in quality.

An ammonia system is used for cooling the tempering water. Some slight trouble was experienced at first on account of the cooling coils becoming coated with ice, thus reducing the efficiency of the system. The trouble was eliminated by raising the expansion pressure.

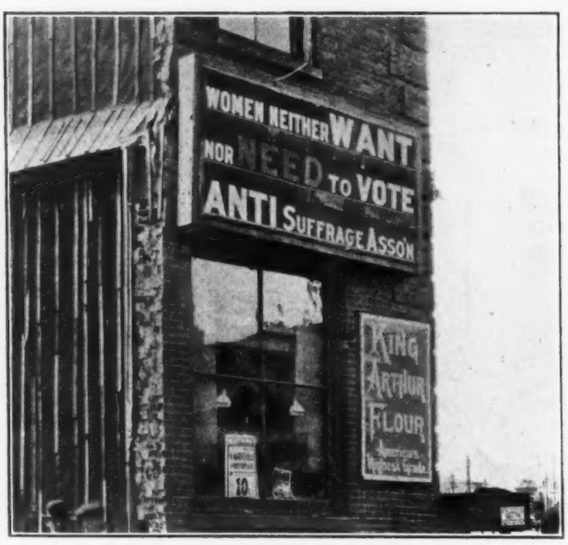
Two tanks, capable of holding 70 cu. ft. and 130 cu. ft. of water respectively, are used for tempering the steel. The water is circulated through the tanks and over ammonia cooling coils by a centrifugal pump driven by a 3-hp, three-phase Wagner motor which operates at 1720 r.p.m. About 40 gal. of water is circulated per minute.

"Heats," each consisting of eight bars of steel at 1500 deg. to 1600 deg. Fahr., are drawn from the furnace every ten minutes and immersed in the smaller tempering tank, the water in which is kept at about 35 deg. Fahr. The bars, which weigh about 22 lb. apiece, are cool enough to handle with the bare hands one minute after immersion. When tempering steel plates it is not necessary to maintain such a low temperature, and slightly more tonnage is turned out per day. The large tank is generally used for plate work. About 33.3 per cent more material is tempered with this system than with the old plan where the water was allowed to cool by natural means. Before the refrigeration system was adopted the slow cooling allowed the bars to become partially annealed. This trouble is not experienced now.

A 12.5-ton double-cylinder Maynard ammonia compressor furnishes the refrigeration for cooling the water. It is driven by a 25-hp, three-phase Westinghouse wound-rotor motor which is equipped with a Westinghouse starter. Electrical drive is used for all the machinery throughout the plant. In general group drive is used for the machine-shop tools, but the larger punching and shearing machines have individual motors. The shop is also equipped with a Toledo electric welder capable of accommodating two 0.25-in. plates. By means of a switch on the side of the welder the energy developed in the welding arc can be regulated. Flame-arc and tungsten lamps are used for illuminating the shop.

An Electric Anti-Suffrage Sign

Electricity is being pressed into effective service in the aristocratic town of Brookline, Mass., by the Woman's Anti-Suffrage Association of that famous Boston suburb, through the medium of a 4-ft. by 9-ft. illuminated sign facing the Village Square transfer station of the Boston Elevated Railway Company. The sign, which is shown in the accompanying illustration, is equipped with eighteen 25-watt tungsten lamps run upon a 110-volt circuit through an automatic time switch in an adjacent printing office, energy being supplied by the Edison Electric Illuminating Company of Boston. Every evening at sundown the sign goes on duty, setting forth in somewhat negative terms its opposition to the ballot for the fair sex, but attracting the attention of thousands of travelers on the rapid transit lines and receiving comments both sacred and profane.



ANTI-SUFFRAGE ELECTRIC SIGN

An Electric Vehicle in Emergency Fire-Alarm Service

At Huntington, W. Va., the fire-alarm system is operated by central-station energy. When the power house was put out of commission by the flood the company was confronted by the problem of keeping the fire-alarm circuits in operation. Mr. William R. Power, manager of the commercial department of the Consolidated Light, Heat & Power Company, ran an electric vehicle up to the fire "central" and connected enough cells to the alarm system to provide the proper voltage. Within ten minutes after the service was renewed a "three-alarm" call came in from the business district. The enterprising central station which uses electric vehicles never seems to be at a loss to keep its rolling stock in action, and in times of emergency the vehicles seem to be the most reliable of all central-station auxiliaries.

Rehabilitating a Small Central Station

The maintenance of high standards of operation in very small central stations is often a difficult problem, but experience shows that unless good service is rendered within wide limits, a little company serving one or two villages is liable to become ruined financially just as a city plant of poor design and operated in a slipshod manner is in danger of going to the wall. In view of the thousands of small plants still in service in the country districts, the following critical study of a 60-kw installation at East Haddam, Conn., may be suggestive to the operating man.

The generating equipment consisted of a vertical waterwheel rated at 170 hp under a head of 20 ft., but on account of the bad condition of the dam the working head did not materially exceed 15 ft. By means of bevel gears the power was transmitted from the turbine shaft to a horizontal shaft and pulley in turn, belted to a main countershaft, from which was driven the 60-kw, 2300-volt generator with exciter. As an auxiliary source of power in times of low water or accident to the water-power, a 35-hp gasoline engine was so placed that it could be belted to the main shaft.

On account of the combined belting and shafting losses, the central station could not supply power even at its normal rating for more than half the capacity of the generator. The interior of the station was both inconvenient and unsafe on account of the mechanical complications existing. The water privilege was unquestionably valuable, but the outflow from the turbine was seriously retarded by rocks and sedimentation in the tailrace, so that a further loss of about 2 ft. in working head was encountered.

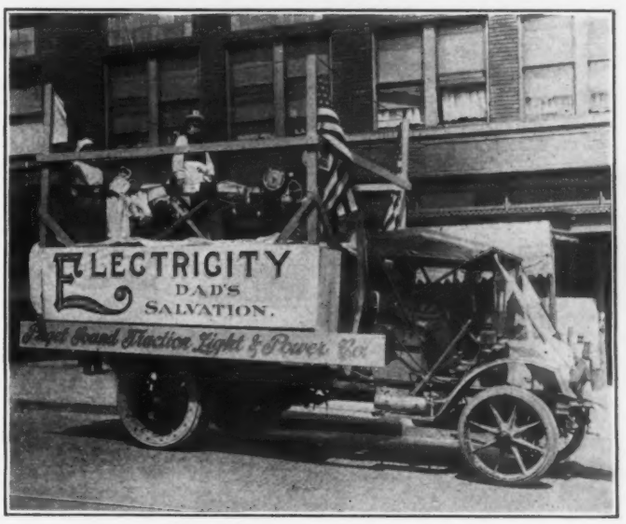
The electric distribution system was of the two-wire, single-phase type and in good repair, but the transformers appeared to be placed more with an eye to economy in first cost than with regard to location, spacing and load requirements for good service. Some of the branch lines supplying small single transformers were too long for their size of wire, and the local transformers in some cases were too small for properly carrying their loads. From eight tests made in various houses and stores it appeared that the pressure ran from 10 volts to a maximum of 26.5 volts below the standard, 110 volts, at which the secondary services were rated, resulting in dim lighting and a loss of about one-third to nearly half the rated candle-power of commercial and residential customers' lamps. Faulty joints and connections were found, besides high-resistance leaks in transmission lines and transformers. Speed regulation was by hand only, at the wheel.

The improvements recommended were the installation of additional transformer capacity, the better spacing and selection of transformers, increased capacity of lines found inadequate on test, reduction in belting and elimination of one shaft and belt drive, installation of an automatic governor, provision of an automatic voltage regulator, ultimate provision of duplicate three-phase generators, one to be direct-connected to its waterwheel, repairs at the dam, remaking of all poor joints, and the cleaning and deepening of the tailrace.

This called for what was practically the rebuilding of the plant, but the service was so poor and the cost of operation so great a proportion of the income that the engineers making the examination recognized that the only salvation of the plant lay in its complete modernization within the possible hydraulic limits of the property.

Electric Float in Seattle's "Golden Potlatch" Celebration

The float shown herewith was entered in the recent "Golden Potlatch" parade, held in Seattle, Wash, July 19, by the Puget Sound Traction, Light & Power Company. A "dad's day" parade was included in this year's "Potlatch" antics. Floats showing "dad" attending to affairs of the home, washing dishes, mending, taking care of the babies during the matutinal hours, sitting up with sick friends, etc., were exhibited. Bringing up the rear was the float "Elec-



ELECTRIC FLOAT AT SEATTLE

tricity, Dad's Salvation." "Dad" in this case was one of the oldest employees of the Puget Sound Traction, Light & Power Company and had been with the company and its predecessors since their inception. An electric motor operated the washing machine in the picture and the ironing was done with an electric iron.

Limits of Error for English Watt-Hour Meters

The British Board of Trade, which passes on electrical construction and supply matters, has fixed the following limits of error for watt-hour meters measuring direct current and single-phase alternating current:

"Meters in which the maximum current for full load—

"(*a*) does not exceed 3 amp—the error at any point from one-tenth load to full load must not exceed 3½ per cent plus or minus;

"(*b*) exceeds 3 amp but does not exceed 50 amp—the error at any point from one-tenth load to full load must not exceed 2½ per cent plus or minus;

"(*c*) exceeds 50 amp—the error at any point from one-twentieth load to one-tenth load must not exceed 2½ per cent plus, and at any point from one-tenth load to full load must not exceed 2½ per cent plus or minus."

Illumination and Wiring

Spectacular Sign for San Antonio

The largest electric sign south of the Mason and Dixon line has just been erected in San Antonio, Texas. It has the distinction of being one of the most elaborate spectacular displays ever made. It measures 50 ft. high and 85 ft. wide, and contains 6500 lamps. The effect depicted is a man on horseback roping a steer with a lasso. The animals are first shown running and then the steer falls and struggles as he is tripping the rope. The sign was erected by A. H. Cadwallader, San Antonio, the flasher mechanism and color caps being furnished by Betts & Betts, New York.

Cost of Street Lighting in Chicago

In the course of a talk before the City Club of Chicago recently on "Street Lighting in Chicago—Accomplishments and Proposals," Mr. Ray Palmer, the city electrician, gave some interesting figures on the cost of the new street lighting of that city. He exhibited a wall map of Chicago, colored to show the work done or in progress in electric street lighting in various parts of Chicago under the existing contract with the Sanitary District of Chicago. That contract was executed in October, 1910, and at the time the city of Chicago had 12,200 street arc lamps. These were taken over by the Sanitary District, which also agreed to install 10,000 additional 10-amp flame-arc lamps, or their equivalent, within three years. At the present time, Mr. Palmer said, there are in service on the streets of Chicago 16,200 arc lamps or their equivalent. The remaining 6000 will be in service within a year. The energy is furnished to the city on the basis of $15 per hp-year of 4000 lamp-hours, or approximately 0.5 per cent per kw-hr.

Recently, as the result of a report made to Mayor Harrison by Mr. Palmer, there have been conferences with the Sanitary District trustees in the endeavor to negotiate a supplementary contract whereby 15,000 arc lamps could be added to those now under contract and the 7-amp alternating-current arc lamps could be replaced by 10-amp flame-arc lamps or series-tungsten lamps. This proposed extension would cost between $3,000,000 and $4,000,000. On July 10 the Sanitary District trustees reported that they would be unable to accept this new contract until the government granted an increased flow from Lake Michigan through the various channels of the Chicago Drainage Canal. At the present time the district is allowed to take 4167 cu. ft. per second from the lake. This proposed addition of 15,000 arc lamps is therefore held in abeyance.

To light one mile of street, using twenty-three flame-arc lamps, with underground wires, costs about $9,000, while if the wires are placed overhead the cost is only about $4,000. These figures include substation and feeder distribution costs. On some of the older residence streets, where the trees are well-grown and act as an obstruction to the light from arc lamps, a system of underground cables and tungsten lamps mounted in opalescent globes on the old gas posts has been installed. This type of construction costs about $8,000 per mile of street lighted, using seventy-five of the tungsten lamps staggered on both sides of the street and about 150 ft. apart, measuring on one side of the street.

Flame-arc lamps on underground circuits cost in 1912 $39.91 a year to maintain. To this should be added an interest charge on investment of $19.16 and a depreciation charge of $13.67, making the total yearly cost, according to Mr. Palmer's figures, $72.74 per lamp. While the lamps on overhead circuits cost as much to maintain the interest and depreciation costs are lower, bringing the total yearly cost down to $54.57.

The underground-cable tungsten-lamp street lighting is the most expensive form of public street lighting used in Chicago except gasoline lighting. The cost per unit is only $13.36 for cash maintenance of this type of lamp, but the interest and depreciation bring the total amount to $24.27 per lamp per year. As there are seventy-five lamps to a street mile, this means $1,820 a year to light one mile of street with series tungsten lamps as against $1,673 for flame-arc lamps on underground circuits and $1,255 for flame arcs on overhead circuits. The corresponding figure for gasoline lighting is $2,343.75.

Mr. Palmer made an interesting comparison between street-lighting conditions in Philadelphia and Chicago. Philadelphia has a population of 1,549,000 (1910), an area of 129 square miles with 1752 miles of streets and alleys. Chicago has a population of 2,185,000, an area of 194 square miles with 4400 miles of streets and alleys. The annual cost of street lighting in Philadelphia is put at $2,472,000, or $1,412 per mile of streets and alleys. The corresponding figure for Chicago is $1,038,700, or $234 per mile of streets and alleys for public lighting. According to these figures, Chicago spends less than 20 per cent (per year per mile of street and alley lighting) of the similar expenditure in Philadelphia.

Attention has been given recently to the lighting of street crossings under the elevated-railroad tracks, or subway crossings, as they are called. There are about 625 of these subways in Chicago. The railroad companies will be forced to install and maintain lamps in 275 of these subways, the city being required to light the remaining 350. After an investigation a standard of one 16-cp lamp for each 400 sq. ft. of inclosed subway area was decided upon as sufficient. The railroad companies have been trying to reduce this standard to one 16-cp lamp for each 800 sq. ft., but the Department of Electricity has refused to agree to this.

Supplementing the above in his recently issued annual report, Mr. Palmer asserts that the city of Chicago was operating on Dec. 31, 1912, 13,830 arc lamps and 862 series tungsten lamps. The city also rented 920 arc lamps and sixty-three tungsten lamps from the Commonwealth Edison Company. The average number of arc lamps owned and operated wholly by the city during the year was 12,735. The average cash cost of the operation and maintenance of these 12,735 lamps is given as $34.26 per lamp per year. This sum does not include interest, depreciation, lost taxes, rent of offices in the City Hall, rental of poles belonging to other companies, nor the cost of work done for the Department of Electricity by other branches of the city government. Adding these to the "cash cost," the total cost per lamp per year is placed at $60.32. Of this $13.52 is credited to depreciation and $7.65 to interest. The contract price of rented arc lamps is $75 a year.

Analyzing the $34.26 given as the cash cost for operation and maintenance the largest item is $10.60 paid for electrical energy to the Sanitary District. The next largest item of cost is $9.39 for lamp trimming, while repairs to circuits, conduits and posts cost $6.59, and carbons $2.84. The total cost of maintaining the municipal electric street-lighting system of the city in 1912 was $432,335.

Depreciation is figured at the following rates applied to original cost: Buildings, 1.08 per cent; steam equipment, 4.1 per cent; electrical equipment, 4.7 per cent; repair-shop equipment, 10 per cent; lamps, 6.66 per cent; circuits, 4 per cent; conduits, 3 per cent; posts, 3.5 per cent. The general interest charge is figured at 4 per cent on the value of the electric-light system less the amount payable to the Sanitary District.

The number of gas lamps in use for street lighting on Dec. 31, 1912, was 15,740 and the number of gasoline lamps 8678. The total number of municipal street lamps of all kinds in service in Chicago on Dec. 31, 1912, was 40,259. The city electrician recommends that gasoline street lamps be discontinued as fast as it is practicable to make extensions of electric or gas service.

Support of Cables for Interior Work

It frequently happens that cables have to be supported beneath ceilings having arched construction, and supports at the drop beams are too far apart to keep the cable from sagging considerably. A simple device is used by the Freeman-Sweet Company of Chicago to avoid this difficulty. As shown in the accompanying illustration, the cable is

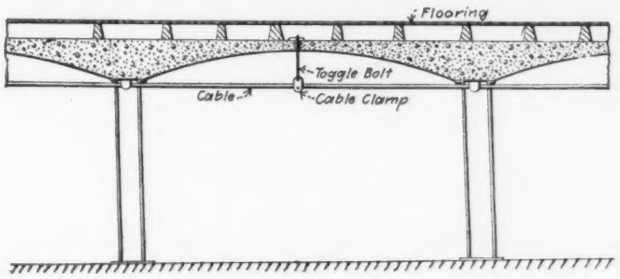


DIAGRAM SHOWING METHOD OF SUPPORTING CABLES

supported at the drop beams in the ordinary manner. Between the drop beams and beneath the crest of the arch a cable clamp is secured to the cable and also to a toggle-bolt which may be shoved through a small hole in the arch above. The toggle-bolt is of the collapsible type, and all that is necessary to install it is to drill a hole just large enough to allow the head of the toggle to slip through, the bolt being moved around until the toggle opens. This method has been found satisfactory both as to ease of installation and as to the result obtained.

Distribution Line Records—I

By H. A. Holmes

While central stations are usually careful in the keeping of records of their equipment, quite a few companies do not possess an adequate method of keeping track of their distribution lines, both underground and overhead, especially as regards the size of lines and their exact location in ducts or on poles. The object of the writer is to outline a system which may easily be kept up and which will enable vital information to be obtained immediately. Maps similar to those described have been in use by many companies for a long time. For some of the valuable features of them the writer is indebted to the Chesapeake & Potomac Telephone Company, of Washington, D. C.; for others to the Potomac Electric Power Company, also of Washington. Other features of the system, it is believed, originated with the writer.

The basis of the system lies in the maps referred to above. A feature of these maps is that all streets except those necessary to identify the lines have been omitted. This relieves the map of considerable unnecessary and confusing detail. This plan is followed by the Chesapeake & Potomac Telephone Company. Another feature is that instead of using drawing ink for showing the various lines water colors are used. These are mixed in a small water-color pan and used with a ruling pen for lines or with an ordinary pen for lettering. When a change is to be made a wet brush is passed over the lines, thereby removing them. Colors which will remove easily should be chosen and should be mixed so that only a faint line is produced, just heavy enough to be clear and distinct. The first three illustrations represent a series of maps such as are used by the Potomac Electric Power Company. It should be stated that the feeders and circuits shown are mythical and for illustration only. The scale of the maps should be made generous so that there will be no crowding such as is apparent in the illustrations, which are much reduced.

Fig. 1 shows the high-tension feeders from the main station to substations, the lengths and sizes of the lines being given with such other data as are desirable.

Fig. 2 shows the primary lines from substations and main station to the transformers. On this map are indicated only the poles and manholes where transformers, lightning arresters, section switches, etc., are installed. Distances between taps in manholes or on poles shown on the drawing are given, no allowance for the cable in the manholes being made. In the illustration distances are not always written directly on the wire to which they refer because of lack of space. In the map any chance for confusion should be eliminated. Sizes of wire are also indicated. Different colors should be used for the lines from each substation. Poles are indicated by a dot (dots on the underground system, however, indicate taps; these dots have been omitted from the illustrations because of the small scale); transformers by a circle, more than one transformer by concentric circles, and manholes by a small square. Overhead lines are dotted. Underground lines are solid. Where the greater part of the system is overhead these symbols should be reversed, and where transformers are mounted on poles the circle should surround the dot indicating the pole. Lightning arresters are indicated by a square surrounding the pole. Where a transformer bank is fed from more than one substation the circle is made solid, half one color and half the other. The number, make and size of the transformer are indicated consecutively on the drawing. Manhole numbers have been omitted from all of the illustrations, as the illustrations do not have any colors to help in distinguishing various lines and figures.

With a direct-current system this series would give the feeders from the substations and main stations to the point of attachment to the distributing mains, which is indicated by a solid circle. The same procedure is followed as above when one distribution main is fed from two substations.

Fig. 3 represents a series of maps of various districts showing the secondary distribution, the manholes and pole location. For direct-current systems this series shows the distribution mains from the point where the feeder connects. The wire sizes should be shown as in Figs. 1 and 2. They have been omitted in the illustration because of the work involved in selecting sizes which would not seem ridiculous. When colors are used the lines from various substations can be easily distinguished.

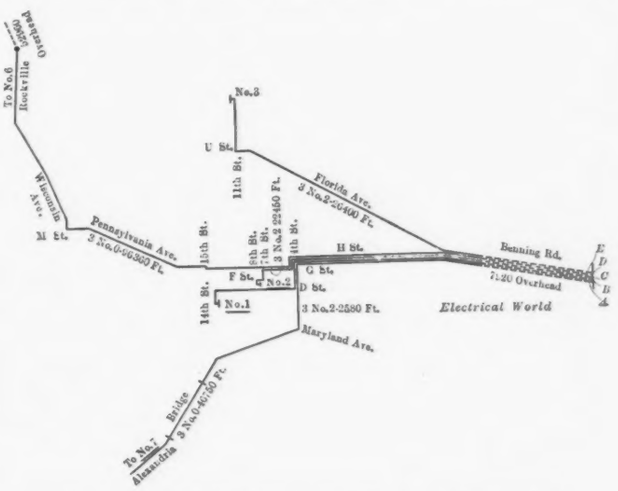


FIG. 1—HIGH-TENSION FEEDERS TO SUBSTATIONS

Fig. 4 represents a series of individual maps for each primary or feeder and the secondary or distributing mains from that primary or feeder. All manholes and poles on the circuit and their numbers are shown and the distances between manholes given. Some companies might wish to have the data represented on these drawings Figs. 1 to 4 tabulated in a book. Instead of this, the use of cards

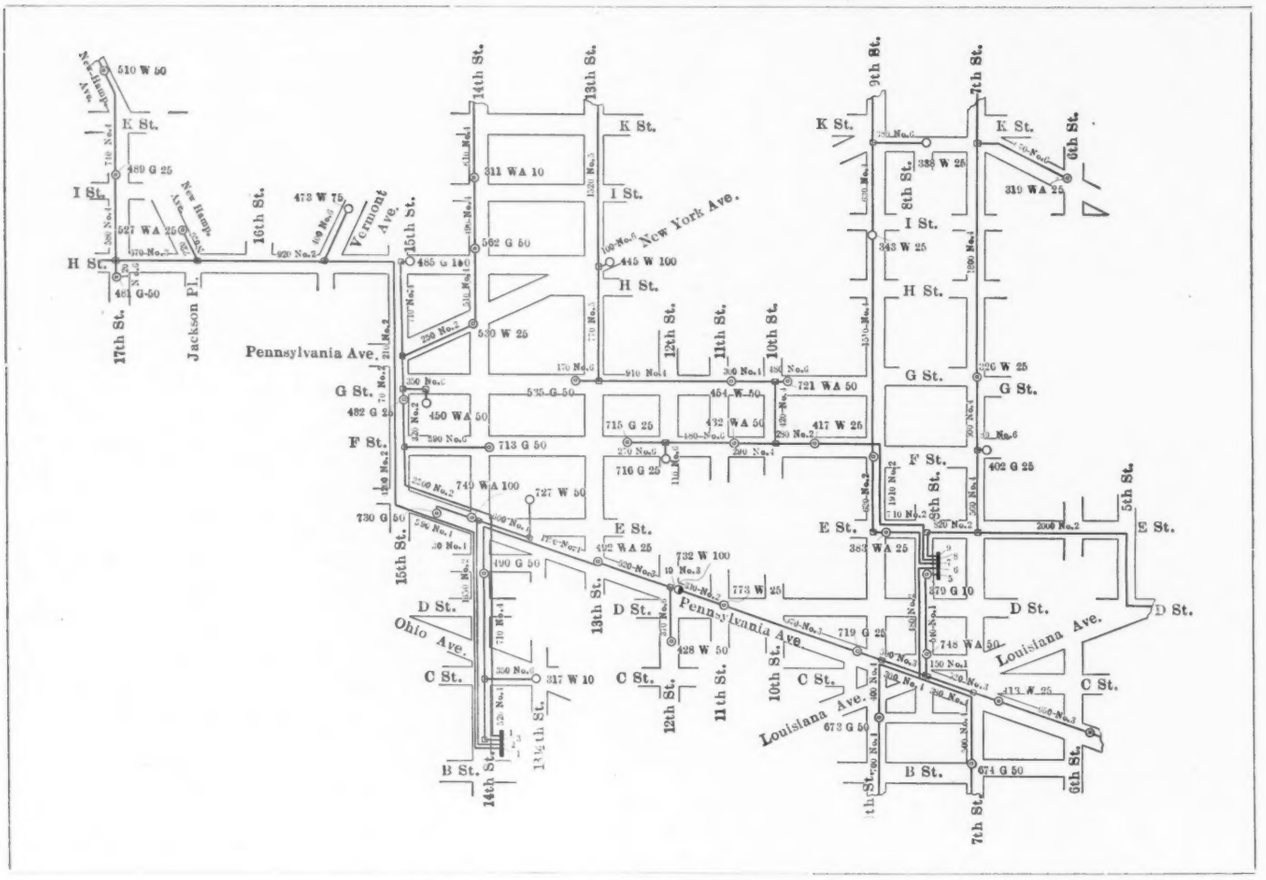


FIG. 2—PRIMARY LINES TO TRANSFORMERS

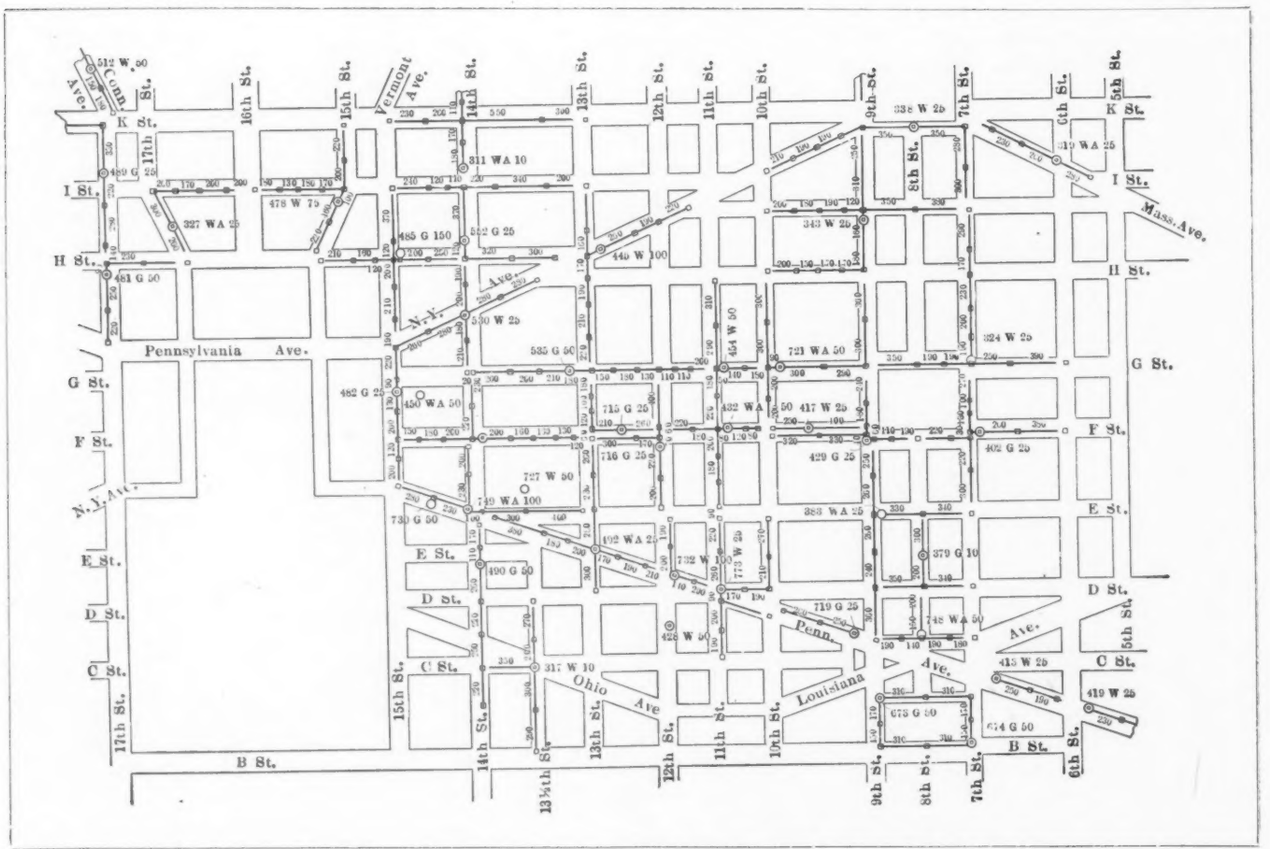


FIG. 3—MAP OF SECONDARY LINES, SHOWING MANHOLES AND POLES

is suggested. The writer prefers the map method. Wire sizes should be shown, although they have been omitted from the drawing for the same reason as in Fig. 3.

Fig. 5 represents a series of drawings of the duct lines and connections, prepared at the time of installation. These should give the location of the duct line in the street, the elevation of the street and the depth of the top of the

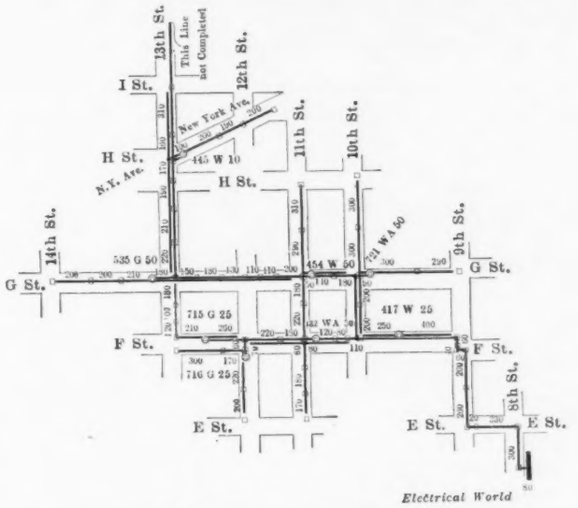


FIG. 4—PRIMARY AND SECONDARY MAINS

duct below the surface or cover, denoted by *c;* location of manholes, handholes and their size (if not standard), and service connections to buildings.

Service connections have been omitted from the illustration. In this series there would also be included any drawings of standard and special manholes and handholes required. For these drawings it is recommended that standard sizes be chosen, each an even multiple of the next smaller size and each having a type letter besides being numbered serially. A card index should be provided and the drawings filed by street name or number. Drawings of any particular service should be filed under the number of that building also. For instance, if Drawing C 1431

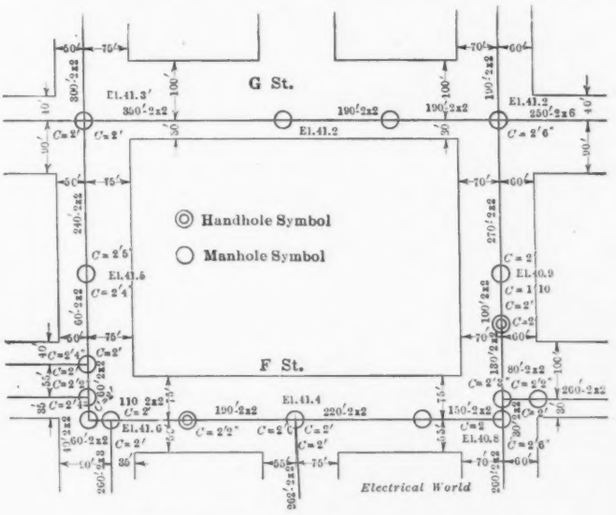


FIG. 5—DUCT LINES AND CONNECTIONS

shows the portion of D, E, F and G Streets between Seventh and Tenth Streets, the following cards should then be prepared to index this drawing: D Street between Seventh and Tenth Streets, Drawing C 1431; E Street between Seventh and Tenth Streets, Drawing C 1431; F Street between Seventh and Tenth Streets, Drawing C 1431; G Street between Seventh and Tenth Streets, Drawing C 1431; Seventh Street between D and G Streets, Drawing C 1431; Eighth Street between D and G Streets, Drawing C 1431; Ninth Street, between D and G Streets, Drawing C 1431; Tenth Street between D and G Streets, Drawing C 1431.

From these cards the proper drawings can readily be located. This method of filing drawings is in use by the Chesapeake & Potomac Telephone Company.

A continuation of this article, with illustrations of the card system of records, will appear in a subsequent issue.

Recent Telephone Patents

A high-powered transmitter has been patented by Mr. R. S. M. Mitchell, of Syracuse, N. Y. Instead of the usual granular microphone button he has provided spiral cylinders of carbon or other suitable material. These are symmetrically placed within a cylindrical box. A circular diaphragm closes the face of the box. A stud is attached to the diaphragm and from it a lever extends to each of the carbon cylinders. Spring fulcrums are attached to the levers at suitable positions between the central stud and the cylinders. As the convolutions of the cylinders close the resistance becomes rapidly lessened.

Mr. M. Weil, of New York City, has termed his invention a telephone muffler. It consists of a hood attachment adapted to clamp over the face of the transmitter in such a way as to inclose the mouthpiece. The front of the hood is shaped so that the edge will conform to the contour of the face of the user, the lips of the user being within the lips of the hood. The novelty in this muffler lies in using double walls for the hood, the space between the walls being exhausted sufficiently to serve as a non-conductor of sound.

Messrs. A. B. Allen and Leonard Day, of New York City, have designed and patented a desk-stand set with a view to its being readily made ornate. This desk stand has no hook switch of the usual type but instead carries a plate surmounting the circular base upon which the receiver is to be laid when not in use. The weight of the receiver causes a depression of the plate and thereby operates the switch contacts.

Letter to the Editors

A Step Toward the Metric System

To the Editors of the Electrical World:

SIRS:—It may be of interest to your readers to learn that the unit of length for all electrical measurements now made in the factory of the Simplex Wire & Cable Company is 1000 ft., which since May 14, 1913, has been substituted for the earlier unit, 5280 ft.—the mile. Since the date mentioned insulation resistance has been measured in megohms per 1000 ft.; conductor resistance in ohms per 1000 ft.; capacity in microfarads per 1000 ft., and inductance in henrys per 1000 ft.

The change in the unit of length will save much time in making calculations, of which about 1000 are required in the factory daily. The change is on the lines of simplicity and efficiency, and there is apparently nothing but inertia to prevent its adoption.

It is worthy of note that an error of less than 6 per cent is involved when the values for the mile length are multiplied or divided by five to obtain the values for the 1000-ft. length. For insulation resistance, at least, the error is well within the limits of manufacture.

EVERETT MORSS,

Boston, Mass. *President Simplex Wire & Cable Company.*

Field of the Operating Engineer

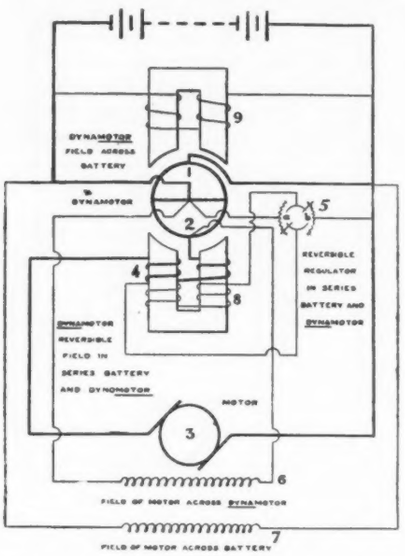
A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

A Battery-Conserving Vehicle Transmission System

The Crompton "electric valve" for controlling the discharge rate of vehicle batteries to a predetermined maximum accomplishes three results:

Firstly, the life of the battery is increased, resulting in lower upkeep and more uniform reliability; secondly, the battery will give its maximum output of work, and, thirdly, a reduction in weight can be gained for any required service conditions as compared with the weight of a straight-battery equipment.

The so-called "electric valve" as described by Messrs. W. H. Watson and R. J. Mitchell before the British Municipal Electrical Association, London, is really a special form of dynamotor which operates in connection with a compound-wound motor, the field of which is designed to strengthen up as the motor speed falls. The torque-speed characteristic of this machine is of the same form as that



AN ECONOMICAL VEHICLE TRANSMISSION SYSTEM

of a series motor; hence, a heavy current at low voltage can be used to maximum advantage at starting, a feature essential for rapid acceleration and which makes regenerative speed control of the car a successful possibility.

Referring to the diagram, the machine 1, 2 has really two functions—one being that of a motor across the battery terminals, the other that of a dynamo connected in series with the motor 3, which can thus receive a maximum voltage equal to the dynamo voltage plus the battery voltage. In this design the limit of maximum voltage across motor 3 is twice the battery voltage. The motor part of 1, 2 is excited at constant potential by a shunt coil across the battery terminals. The excitation of the dynamo part is provided by coil 8, which is in series with a reversible regulator 5 and the battery, so that it is thus possible to vary the excitation due to this coil between wide limits. Thus, with the battery voltage opposing dynamo voltage, the field would be full negative, while when the battery and dynamo voltages are added the field would be full positive. The controller arm will therefore on one side cause the dynamo voltage to be added, and on the other side subtracted, from the voltage due to the battery. The dynamo is also provided with a coil 4, in series with the motor 3, and opposing coil 8 when motor 3 is taking energy from the dynamo.

The excitation of the motor 3 is effected by two shunt coils, one, 7, being across the battery, while the other, 6, is across the dynamo 2. These coils are so arranged that during starting and subsequent acceleration the field of motor 3 is due almost entirely to coil 7. As speed increases the field due to coil 6 increases, and thus opposes winding 7, the field finally attaining a value which is the difference between the stronger field induced by coil 7 and that induced by 6. Thus when decelerating, due to increase of load on motor 3, the field of the dynamo will be weakened, due to the increase of current in series coils 4. This will cause an automatic limitation of the current possible to be taken from the dynamo, since, at the same time, the voltage across coil 6 will be reduced, thus strengthening the motor 3 field owing to the difference between the excitation from windings 7 and 6 becoming greater. But with a stronger field the torque of motor 3 increases, while speed tends to decrease, due to the fall in voltage across the dynamo occasioned by a heavier current in winding 4. The motor 3 is designed to deliver a torque nearly proportional to the square of the current; thus a quick start can be made from standstill involving a current only 2.5 times normal current for level running. The resistance losses are therefore low. An average acceleration of 4.5 ft. per second is obtainable under normal level running conditions.

The operation of the system will be clearer if a sequence of operations be followed in detail as they would occur on the road. When the vehicle—in this case a thirty-four-passenger bus—is at rest the reversible controller will be in the position *a b*, so that there is full negative excitation of machine 2. Current having been turned on to machine 1, the controller is now turned toward the side corresponding to full positive field on machine 2, say to the left. Assuming the torque on the motor to be sufficient to move the bus and that the controller handle be not touched, the current flowing in coil 4 will reduce the field of 2, hence its voltage will fall and the strength of motor 3 field will increase, thus tending to slow up the motor. Meanwhile, however, the bus is accelerating and will continue to do so until uniform speed is attained. A further movement of the controller handle increases the field due to winding 8, thus allowing more current to flow through the motor 3, and weakening its field because of the increased current through the winding 6. Finally the motor is rotating at maximum speed for the particular conditions. The action of braking the bus is achieved by reversing the handle of controller 5. This has the effect of reducing the voltage of the dynamo to a point lower than the back emf of the motor 3. Hence current flows back into the battery. The amount of this regenerative changing current is regulated automatically by the field coil 4, which increases the value of the back emf of the machine 2, thus preventing the possibility of doing damage.

Obviously the chief part of the driver's work is simply to press a single pedal, which controls speed and braking as already noted. It would be possible to drive without using a mechanical brake; in fact, recourse to a brake other than electrical is necessary only in an emergency. By suitably

proportioning the resistance of 5 a small negative current is caused to circulate in the driving motor 3, giving the armature a slight torque in the reverse direction. This useful property enables the Crompton 'bus to stand on a hill with a "backward" declinity of 1 in 28.

Experiments made recently in London streets under similar conditions to those existent in practice showed that over a city route of 11 miles 17 per cent of the battery energy withdrawn was returned to the cells owing to the regenerative action of braking—mainly on account of the numerous traffic stoppages.

Method of Locating Grounds in Armatures

It is often very difficult to locate a low-resistance or "dead ground" in a low-voltage armature owing to the very low resistance of the windings themselves. In such cases, however, the following method can be employed with very good success:

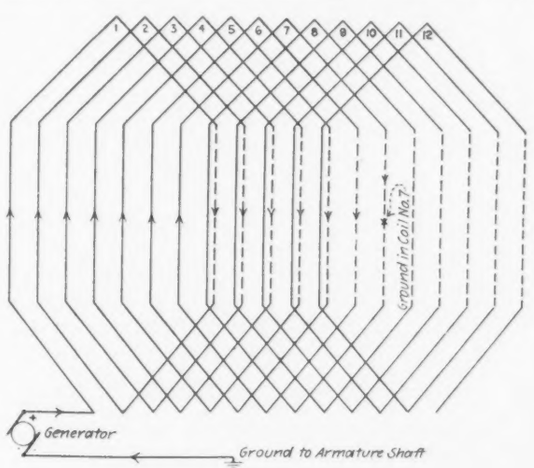
First, short-circuit all commutator bars by winding several turns of bare copper wire around them; then apply a source of energy, direct current preferred, to the commutator and shaft. The voltage to be used depends upon the resistance of the "ground."

This produces a circuit from the commutator through the grounded coil to the ground and out through the shaft, thus setting up a field around the conductors in this coil. By applying a small piece of iron to the surface of the armature core and gradually moving it around, one can readily locate the grounded coil by means of its field, which attracts the iron.

The same method can also be applied to alternating-current apparatus, although not quite so readily. For example, in the case of a three-phase, single-circuit, Y-connected armature, first disconnect the Y, splitting the winding up into three separate circuits. Then test out each circuit with a magneto or some similar source with which the ground can be located.

Next apply a current to one end of the grounded circuit and to the shaft. Assume that there are twelve coils in this circuit, coil No. 7 being the grounded coil, while coil No. 1 is connected to the line as shown in the accompanying sketch.

There will then be a circuit through coils Nos. 1, 2, 3, 4,



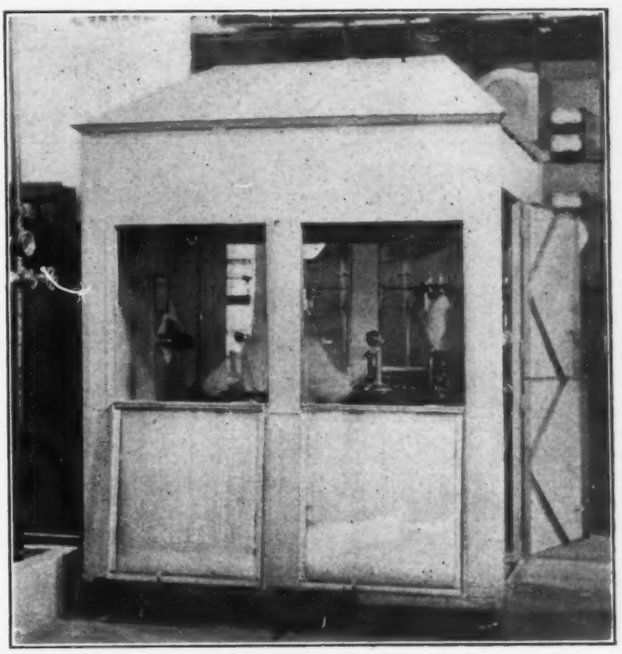
METHOD OF LOCATING GROUNDS

5, 6 and 7 which can be readily detected with a piece of iron as previously explained, while coils Nos. 8, 9, 10, 11 and 12 are dead.

It is then, of course, obvious that if coils 1, 2, 3, 4, 5, 6 and 7 carry a current while coils 8, 9, 10, 11 and 12 carry no current, the ground must be in some section of coil No. 7, the circuit being completed at this point.

Cutting Substation Coal Bills

An effective method of cutting down coal bills and also providing for the comfort of the operating staff in the winter season is shown in the accompanying photograph. The scheme consists of installing a 5-ft. by 6-ft. portable tin house in the main substation transformer room, the house forming a convenient little office where all the tele-



COLD-WEATHER INSTALLATION

phone and clerical work which is necessary can be performed.

This "house within a house" contains a desk, two chairs, two telephones, a 330-watt home-made electric heater, side door, front and rear windows; has a 1¾-in. slate floor, and stands upon six 13,000-volt insulators 6 in. above the main operating-room floor. It faces the switchboard and the general indicators of the instruments can be seen from the interior. The substation contains six transformers of 9000-kw combined rating and is steam-heated in very cold weather; but throughout the greater part of the year the use of the small electric heater in the portable office, where work is done seated, is sufficient to maintain comfortable conditions for the operators and at far less cost than by the usual coal-heating method.

Meaning of Kilovolt-Ampere and Kilowatt

Will you kindly give a short concise definition of the term kilovolt-ampere and explain its relation to the similar term kilowatt? J. B. C.

As its name implies, the kilovolt-ampere, abbreviated kva, is the product of volts times 1000, times amperes, the word kilovolt meaning 1000 volts. The term kilowatt, abbreviated kw, in alternating-current practice is understood to mean volts times 1000, times amperes, times power-factor. Hence a machine might have all or any one of the following ratings on its name plate and still be correctly rated: 200 kva; 200 kw at unity power-factor; 160 kw at 80 per cent power-factor, and so on. Thus it will be seen that the advantage of rating a dynamo-electric machine in kva instead of kw lies in the fact that a kva rating tells what load the machine will carry under all conditions, whereas if a kw rating is given, other facts must be stated before it will be known what the machine will be able to do under all conditions of load and power-factor.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

High-Speed Generators.—Maurice Leblanc.—The conclusion of his illustrated article on the design of direct-current generators for very high speed. The general construction of the machine is outlined with the aid of diagrams. Its theory is given with special reference to self-excitation and the possibility of producing currents of any desired frequency.—*La Lumière Elec.,* July 19, 1913.

Three-Phase Commutator Motors.—Rüdenberg.—A paper illustrated by diagrams presented before the Leipzig Electrical Society. The author describes the different types of three-phase commutator motors, gives the circular diagram and discusses cascade connections.—*Elek. Zeit.,* July 10, 1913.

Mercury-Vapor Converters.—Maurice Leblanc.—The author first deals with the principle of mercury-vapor converters and their capacity and efficiency. He next takes up the question of the operation of this apparatus from the theoretical side and describes the uses of the conveter. Metal converters are briefly mentioned.—London *Electrician,* July 18, 1913.

Lamps and Lighting

Evaporation Temperature of Carbon in the Arc Lamp.—Lummer.—An abstract of a paper read before the German Illuminating Engineering Society. If the carbon in the arc lamp has a temperature of evaporation, the temperature of the carbon must be independent of the arc length and of the current, but must change with the atmospheric pressure like the evaporation temperature of any substance. From tests made by the author it appears that the temperature is independent of the current (the variation being less than 1 per cent if the current is varied between 6 amp and 60 amp). Further, the temperature of the positive crater decreases from 4000 deg. absolute temperature to 3800 deg. if the pressure is reduced from 1 atmosphere to 0.25 atmosphere. This seems to prove conclusively that the atmosphere of the crater is really the boiling temperature of carbon. The tests are to be repeated and extended to higher pressures up to 30 atmospheres. The negative crater has in general a lower temperature than the positive crater. A peculiar phenomenon is that the positive crater seems to begin to boil at pressures below atmosphere. The whole surface gives the impression of a boiling film of liquid. This "liquid" condition begins at the pressure of 0.666 atmosphere and appears to disappear again at a pressure of 0.333 atmosphere. This is to be further investigated.—*Jour. f. Gasbel. u. Wasservers,* July 12, 1913.

Arcs and Electrodes.—S. H. Blake and L. H. Couchey.—Electric arcs are of two kinds, those that owe their light-giving properties to incandescence of the electrodes and those that give light by reason of the luminosity of their arc streams. Under the heading of the first come the old open and inclosed carbon arc lamps of both the direct-current and alternating-current types, while classified under the latter are the mercury-vapor and the modern "luminous" and flame-arc lamps. The distinction between the last two lies almost wholly in the manner in which the light-giving material is introduced into the arc stream, whether by electro-conduction or by heat evaporation. Equally difficult with determining the proper substance to use for the light-giving elements or designing the lamp mechanism has been the production of satisfactory electrodes, even for the original open carbon lamps. The electrodes that were suitable for the open arc were too impure and imperfectly formed for the inclosed lamp, and so it has been in each instance of the development of a new arc, new substance for the electrodes, new structure, new diameter and length.—*Gen. Elec. Rev.,* July, 1913.

Boron-Tungsten Compound for Filaments.—A note on a recent British patent (No. 3525, 1913) of F. Hansen and W. F. Mohr. Tungstic trioxide is saturated with a solution of boric acid and then dried and heated in a neutral atmosphere. It is next mixed with zinc powder and reduced by heat. The zinc is removed by hydrochloric acid and the residue thoroughly washed.—London *Elect. Eng'ing,* July 7, 1913.

Electric Light as a Luxury.—E. Schneider.—The author protests against the statement of L. Mantius to the effect that electric light is a luxury. That this is not true is proved by the number of electric lamps in existence in Germany (68,000,000 electric lamps against 25,800,000 gas lamps and 23,000,000 kerosene lamps) and by the rapid rate of increase of the use of electric light. Under the usual conditions kerosene light costs about twice as much as electric light. The author deplores that not all houses, residences and flats in the district of an electric station are connected to the station just as all of them are connected to the water department.—*Elek. Zeit.,* July 10, 1913.

Causes of Voltage Variation in the Operation of Lighting Systems.—J. J. Sullivan.—The maximum degree of satisfactory service is obtained from a lamp when it is burned at its highest efficiency, and for this condition an unvarying "label" voltage is the principal requirement. The author states briefly the causes of unsatisfactory voltage supply and points out where in the system, from generator to lamp, the sources of trouble occur.—*Gen. Elec. Rev.,* August, 1913.

Lamp Laboratory.—E. P. Hyde.—A Franklin Institute paper giving a résumé of the activities of the physical laboratory of the National Electric Lamp Association in the development of the modern science of illumination.—*Jour. Franklin Inst.,* July, 1913.

Motor-Cycle Lighting.—The author states that when a suitable battery and electric lamp are available the electric-lighting outfit for motorcycles is more desirable than the gas equipments now in use, with respect to weight, dimensions, simplicity, convenience and illumination.—*Gen. Elec. Rev., August,* 1913.

Generation, Transmission and Distribution

Compensation Induction Coils in High-Tension Cables.—J. Kühle.—An article illustrated by diagrams discussing the compensation of the charging currents in high-tension cables by means of induction coils connected in parallel. In order to obtain an efficiency of transmission as high as possible it is most important to arrange the induction at the proper places in the cable and to dimension them correctly. It is shown that even for the longest cable lines now in use one or two induction coils are sufficient. With a strongly inductive load the parallel connection of induction coils permits, of course, only small advantages,

if any. A detailed numerical example is given, the results being shown in three diagrams. Finally, the author shows how the use of special induction coils may be avoided if the magnetization current of the transformers connected to the cable line be artificially increased.—*Elek. Zeit.*, June 26, 1913.

Distribution Networks.—G. KLINGENBERG.—The conclusion of his very long paper presented before the German Association of Electrical Engineers on the distribution of electric energy over extended districts. In the present instalment the determinaton of the best distance between poles is discussed and the results are given in various diagrams and tables both for copper and aluminum conductors. —*Elek. Zeit.*, July 17, 1913.

Inductance and Capacities of Three-Phase Transmission Lines.—LOUIS COHEN.—A mathematical paper on the determination of the inductance and capacity of three-phase transmission lines for any spacings between wires and any voltage distribution on the lines.—London *Electrician*, July 18, 1913.

Supplying Energy to Isolated Consumers from Transmission Lines of Moderate Voltage.—E. B. MERRIAM.—The author deals first with the reasons underlying the present-day demand for cheap and reliable substation apparatus for connecting up the isolated consumer with the central-station system. Then, with seven outline drawings, the author presents a specification of the pole or tower structures for distributing various quantities of energy at given voltages from the main line to the consumer, and afterward deals with the different parts of the equipment making up these outfits. The latter part of the article describes and illustrates a number of installations of this character in successful operation.—*Gen. Elec. Rev.*, August, 1913.

Electric Power in Sugar Manufacture.—P. S. SMITH.—The author outlines the processes followed in the modern "central" for the production of refined sugar from the raw cane and lays stress on the imperative demands for the most efficient form of mechanical operation consequent upon the rising cost of producing raw sugar and the decreasing price at which the finished product can be sold. In meeting the demand, the system which will win out is the one in which the fuel bill for the power plant is cut down to the minimum, and this viewpoint puts the electric system in its most favorable light, as it should be possible to raise all the steam for a good turbo-electric station from the refuse cane which is a by-product of the mill. For the rest the article deals succinctly with the suitability of the electric drive for operating the various machines in the mills.—*Gen. Elec. Rev.*, August, 1913.

Traction

Automatic Block Signals.—O. WEHLAND.—An article, illustrated by diagrams, on the automatic block-signal systems and its application on the Berlin elevated railways which are to be electrified.—*Elek. Zeit.*, July 17, 1913.

Installations, Systems and Appliances

Württemberg.—H. KLAIBER.—In Württemberg the government carried out in 1911 an investigation of the money value of all electric installations, including private plants. The author describes the method by which the government proceeded and by which missing data not replied to in the official inquiry were obtained. The value of all electric distribution systems and installations in Württemberg (excluding house installations) is $28,000,000.—*Elek. Zeit.*, July, 1913.

Transformers for Induction-Motor Load.—J. L. MOON.—An article giving rules and tabulated data for determining approximately the size of transformer which must be used for taking care of an induction-motor load of given voltage and horse-power. The latter section specifies and illustrates the wiring connections of transformers and motors which are followed in cases likely to be met with in practice for connecting induction motors to two-phase and three-phase systems.—*Gen. Elec. Rev.*, July, 1913.

European and American Practice in Lightning Arresters.—E. E. F. CREIGHTON.—Practice in lightning arresters in Europe and America has developed along somewhat different lines. In America some of the European practice has been used. In Europe a considerable number of arresters, especially of the aluminum-cell type, have been installed, some of which have been built in America and others in Europe—probably most of them in Europe. The aluminum arrester was developed entirely in America by the author. Its success depends much on the care in manufacture, especially if charging resistors are not used. The same degree of satisfaction has not been found in Europe as in America, and this has apparently produced there a wave of preference for the resistor type of arrester. The object of the present paper is to compare the several forms of arresters that are used in Europe and not in America.—*Gen. Elec. Rev.*, August, 1913.

Passenger Elevator.—E. F. TWEEDY.—The author first outlines the development of all the successful types of passenger elevator, namely, steam, hydraulic (water-balance, vertical and horizontal cylinder), electric (single and variable speed), and drum and traction suspensions. The merits and demerits of each type of drive and suspension are discussed. Curves are included which show the effect upon energy consumption of different counter-weighting, the schedule relation between number of stories and linear speed of travel, and the difference in the time characteristic of two classes of traffic. A two-page tabulation gives complete data of representative installations. The second part of the article explains the method of arriving at the number and size of elevators necessary to fulfil the given requirements of a proposed building, use being made of a curve chart which practically eliminates all computation. In conclusion, the construction and operation of the automatic signal-lamp system are described in detail.—*Gen. Elec. Rev.*, July, 1913.

Electric Cooking.—W. SCHULZ.—An illustrated article on electric cooking on a large scale which describes the electric kitchen of the North-German Lloyd company in Bremen and the apparatus used in it. The kitchen supplies lunch for the 500 employees. The buildings are electrically lighted, and electricity is also used for various purposes, but the load during the day is low so that the energy used in the kitchen may be figured simply as the cost of the fuel, that is, from 0.5 cent to 0.75 cent per kw-hr. The total rating of kitchen apparatus is 194 kw. The average power consumption in the kitchen is from 40 kw to 60 kw.—*Elek. Zeit.*, July 17, 1913.

Mechanical Refrigeration.—E. T. TWEEDY.—An article on mechanical refrigeration from a central-station point of view, with reference to ice-cream making, cold storage of furs and fabrics, and ice-making.—*Gen. Elec. Rev.*, August, 1913.

Wires, Wiring and Conduits

Cable Construction.—C. J. BEAVER.—An illustrated article pointing out the very high electrical and mechanical factors of safety in vulcanized bitumen mining cables.—London *Electrician*, July 18, 1913.

Electrophysics and Magnetism

Electric Field Distribution.—W. S. FRANKLIN.—A discussion of C. Fortescue's A. I. E. E. paper on insulation problems, with a simple demonstration of some fundamental principles of electrostatic theory. The author explains the method of electric images, discusses the possibility of producing any desired field distribution in a region by the creation of proper potential values everywhere over the boundary of the region and explains it by examples. He then discusses the modification of a uniform electric field by a cylindrical conductor. He thinks the word "potential" is an obsession and prefers the ideas of field, strength and

lines of force as being more distinctly physical.—*Jour. Franklin Inst.*, July, 1913.

Units, Measurements, and Instruments

Combined Kilowatt-Hour and Demand Meter.—An illustrated description of a meter which has been designed to enable central-station engineers to charge consumers, particularly motor users, on a load-factor basis, the load recorded being an average load taken over fifteen, thirty or sixty minutes. Thus, in addition to the ordinary unit dials, there is a load pointer moving over a divided scale of 300 deg. The diagrams (Figs. 1, 2 and 3) refer to a three-phase three-wire meter; Fig. 3 is a diagrammatic sketch showing only the essential parts and their relations in order to make the construction and operation clear. In this diagram the induction meter system of a single-phase or polyphase meter will be recognized in the spindle and disk, magnet and counter system, A, M_g, S_1, S_2, W. A pinion on S_2 drives through V, wheel B, which normally gears with wheel M, forming the connecting link between the meter and demand indicator pointer Z. Turning to the lower part of the diagram, the induction motor element E, armature disk B_1, wheel-train and tripping cam C, controlled by a hairspring and escapement H_s, form a timing gear, which, through a trip rod, momentarily lifts A_b at predetermined intervals of time, thus disengaging B from M for the instant. M carries a pin S_t, which in moving pushes the demand pointer Z round until the tripping action takes place when spring F retains the pointer—which is otherwise free on its fulcrum—in its then position while at the same time the spring R returns wheel M and pin S_t to its zero position ready for the cycle of operations during the next time interval. Obviously, if the average load of the next time interval is greater, the demand pointer Z will be carried a little further over the scale, and in fact it will remain at the highest average load indicated until reset. The position of pointer Z is directly dependent on the revolutions which are made by the meter armature in the chosen time period.—London *Elec. Review*, July 18, 1913.

Telegraphy, Telephony and Signals

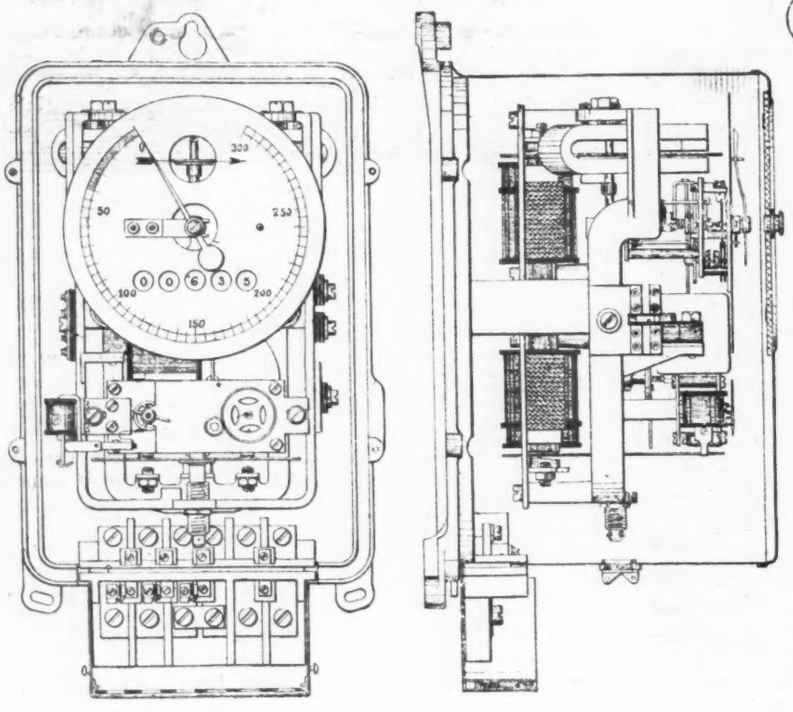
Earth Antennas.—F. Kiebitz.—An illustrated description of the results of careful measurements made in various wireless-telegraph installations with earth antennas.—*Jahrbuch d. drahtlosen Telegraphie;* translated and slightly abbreviated in London *Electrician*, July 18, 1913.

Fire Alarm.—E. E. Moore.—A detailed illustrated description of the Knight public fire-alarm system.—London *Electrician*, July 18, 1913.

Book Review

The Universal Electrical Directory. Compiled by J. A. Berly. Containing a complete record of all the industries directly or indirectly connected with electricity and magnetism and the names and addresses of manufacturers in Great Britain, India, the Continent, etc. London: H. Alabaster, Gatehouse & Company. 1556 pages. Price, £1 1s.

The contents of this book are divided into four sections—the British, with 14,040 names; the colonial and general, with 6550 names; the Continental, with 7640 names, and the United States, with 6255. The entries total 34,485 names, although unimportant names are omitted. Each section is subdivided into alphabetical and classified sections, while in the ease of the British portion a geographical section has been added which is a necessity for travelers. Any section can at once be referred to by means of a thumb index. The lists of electric undertakings in the United Kingdom, the British colonies and some other countries include the following details: The nature of the supply, system of distribution, rating of plant, voltage and chief engineer's name, and in the case of alternating current the phase and periodicity are included. A list of electrical specialties appears in the British section, arranged alphabetically according to the name of the article, followed by the maker's or agent's name and address.



FIGS. 1 AND 2—FRONT AND SIDE VIEWS OF METER

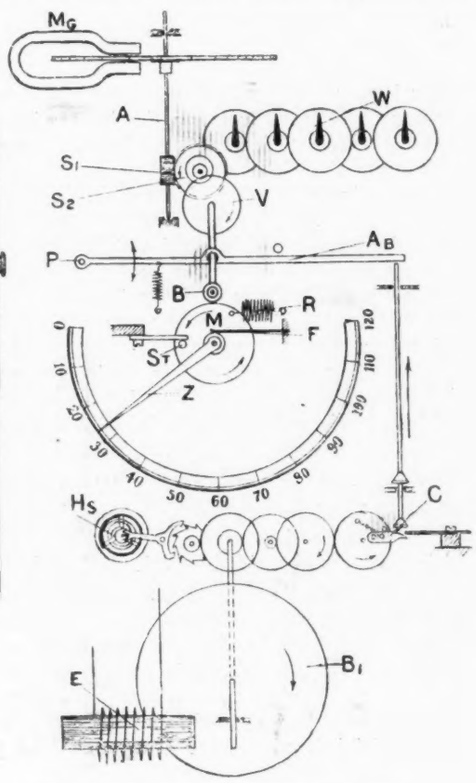


FIG. 3—OPERATING DETAILS OF METER

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Electrically Operated Water System of the Chevy Chase Club

The private water-supply system of the Chevy Chase Club, Washington, D. C., is said to be one of the best in the United States. It comprises two separate systems, one for water supply for the clubhouse and another for irrigating the eighteen-hole golf course. For the latter service there is nearly 5 miles of 2.5-in. water pipe laid throughout the grounds.

The water used in the club house is supplied from drilled wells at various points about the grounds. These wells average about 100 ft. in depth. The illustration shows one of the four deep-well pumps made by the Goulds Manufacturing Company, Seneca Falls, N. Y., for pumping water from these wells. The working head shown is driven by a 2-hp electric motor and operates a 3.75-in. by 10-in. cylinder which is located 90 ft. below the surface. There are two 10-in.-stroke equipments like this one and a third 16-in.-stroke head. The fourth equipment is driven by a 3-hp motor.

The water is delivered through 2.5-in. piping to a storage tank having a capacity of 14,000 gal. in the basement of the club house. To keep the desired level in this tank the motors driving the working heads are automatically stopped

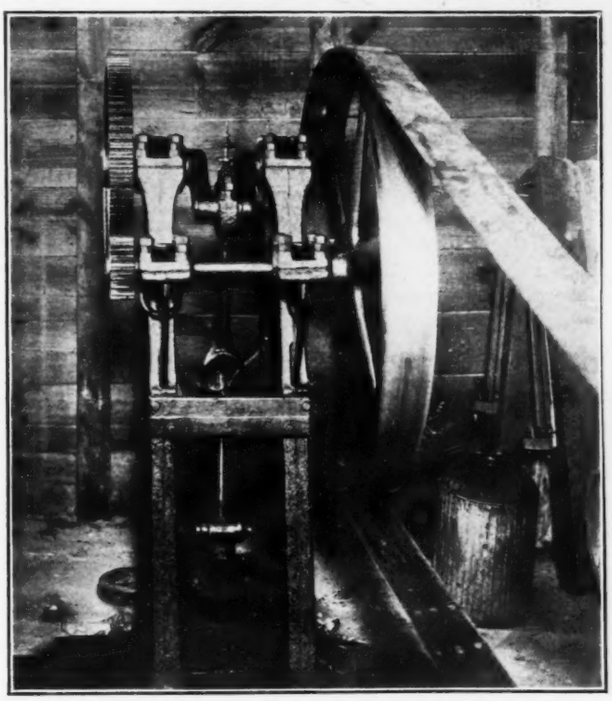


FIG. 1—MOTOR-DRIVEN WORKING HEAD

and started by controllers operated by a float switch in the tank. Disconnecting switches are placed on each of the lines so that in case any one of the wells fails the outfit at this well may be stopped while the others continue to operate.

From the main storage tank in the basement of the club house the water is pumped into two 14,000-gal. compression tanks by a 4-in. by 4-in. horizontal duplex pump, belt-driven by a 5-hp motor and arranged with automatic control to maintain a pressure of from 44 lb. to 60 lb. in the tanks. To replenish the air lost in these tanks by leakage through the water, a 2-in. by 3-in. air pump, belt-driven by a 1-hp motor, is used. There is also a 5.25-in. by 5-in. by 4-in.

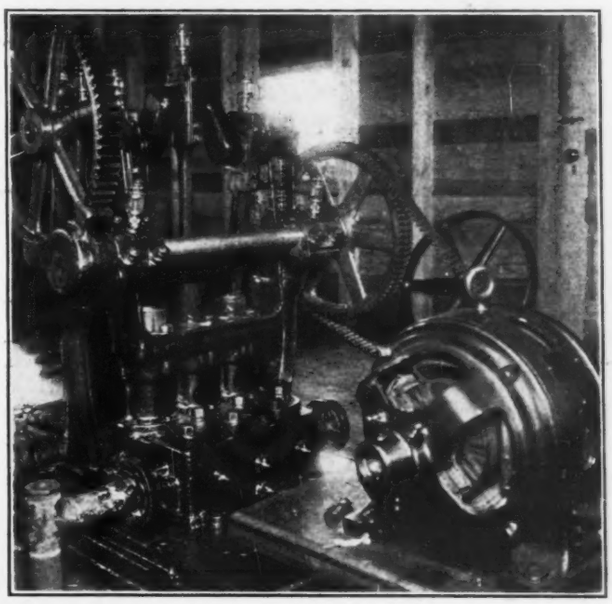


FIG. 2—MOTOR-DRIVEN PUMP

duplex steam pump on this system which is not now used regularly, but is held as a reserve unit.

To furnish the water for irrigation, a pneumatic pressure-tank system is installed near the golf course. The water is pumped from a spring by a 4-in. by 6-in. Goulds triplex pump driven by a 4-hp Wagner motor connected to the pump by a silent chain drive. Automatic control on the motor keeps the pressure in the tank at 55 lb. to 75 lb. The electrical energy for this installation, which was designed by Mr. W. A. McFarland, superintendent of waterworks of the District of Columbia, is being supplied by the Potomac Electric Power Company.

Oil-Immersed Drum-Type Motor Starter

A new design of star-delta induction-motor starter has been placed on the market by the British Westinghouse Electric & Manufacturing Company, Ltd., Manchester, England, embodying some interesting features in its construction.

The internal parts are mounted in a cast-iron frame. The oil tank below forms the lower half of the starter. The contact drum, made on the metal and mica principle, consists of a mica-insulated square steel shaft on which are securely clamped spider castings carrying renewable segmental copper contact strips. All circuits are broken under oil. The no-volt and overload release devices are fitted in the starter above the oil tank. The no-volt coil is connected

across one phase and is so arranged that the circuit to the motor can be closed only when there is voltage on the line. This release is worked by gravity and acts quite independently of the overload release. The overload coil is connected in two phases and is cut out in the star position.

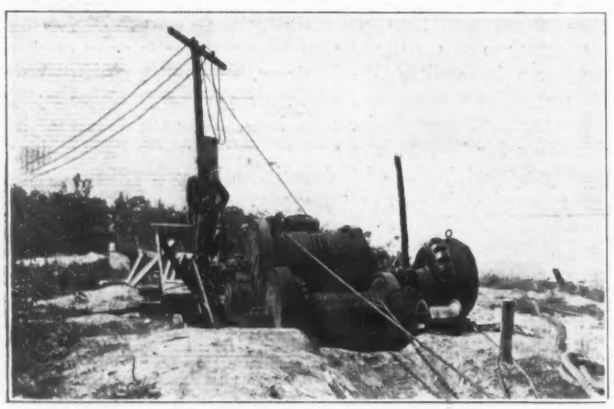
The operating mechanism is so arranged as to make a slight pause necessary at the "star" position before it is

INDUCTION-MOTOR STARTER EQUIPPED WITH AMMETER

possible to move the starting handle through to the "delta" position. The handle cannot be left in the "star" position, since when it is released it flies back to the "off" position. The contact drum is returned to the off position (thus stopping the motor) in the event of an overload on "no-volt" occurring, and it cannot be held either in the star or delta position in such a case.

Motor-Driven Hoist Used as a Scraper

In order to remove the worthless soil above a valuable deposit of clay, the Twin City Brick Company, St. Paul, Minn., uses a drag bucket operated by a motor-driven hoist. The clay deposit forms a bluff above the plant and the bucket is dragged over the surface, removing the soil on its down trip and returning empty. The bucket handles about 300 cu. ft. of soil and makes a trip every two min-



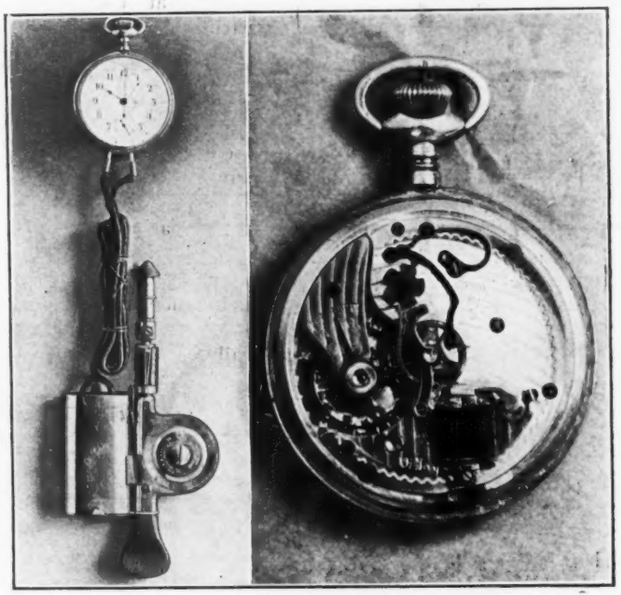
ELECTRIC HOIST OPERATING DRAG BUCKET

utes. A double-drum American hoist driven by a 75-hp Westinghouse induction motor is used to drag the bucket. The use of electric drive is especially desirable for such an operation because it eliminates the hauling of fuel and water, enables one man to handle the entire machine, and involves no delays while steaming up. The hoist, being without a boiler, is also much easier to re-locate.

Electrically Operated Stop-Watch and Revolution Counter

Illustrated herewith is an electrically operated stop-watch and revolution counter invented by Mr. Frederic A. De Lay, an electrical engineer, of 350 Linden Avenue, Aurora, Ill. The stop-watch and counter operate as a unit, starting and stopping simultaneously. A small electromagnet is mounted in the case of the stop-watch and is placed so that when the magnet is energized it will hold the armature in a position such that a small pinion is held out of mesh against the tension of a spring. When the magnet is de-energized the pinion is released and meshes with a gear which is mounted on the spindle of the large second-hand of the watch. The second-hand then continues to run until the pinion is thrown out of mesh, when the magnet is again energized. This electrical equipment does not interfere with the mechanical stem control of the watch, so the latter can be used in the ordinary way.

The complete cycle of operations in using the device in connection with the revolution counter is as follows: First, the electric circuit is closed, thus energizing the magnet and placing the stop-watch under electrical control. Next,



ELECTRIC STOP-WATCH AND REVOLUTION COUNTER

the mechanical control of the stop-watch is released by pressing the stem. The mechanism is then ready for use, and as soon as the electric circuit is opened the long second-hand will start and continue running until the circuit is again closed. The opening and closing of the circuit is accomplished by the revolution counter. The counter carries a free-turning tip which, by a slight pressure toward the shaft, is made to engage a spring the instant the counter dial starts to turn. As soon as the spring is engaged, it is deflected slightly, thereby opening the circuit of the magnet and starting the watch. This circuit remains open as long as the counter is in use. As soon as the counter is withdrawn the spring returns at once to its normal position, thus closing the circuit and simultaneously stopping the watch.

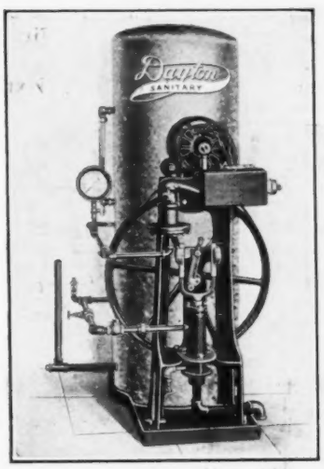
It is to be noted that for each revolution shown on the counter there is a corresponding time interval shown on the watch. This makes it possible to take a few revolutions at intervals—samples, so to speak—and the final reading will give the time corresponding to the total number of revolutions shown by the counter, thus giving a good average. No matter how long the counter is left in the shaft, the revolutions per minute can be easily and accurately determined from the reading. Where the speed of a machine

varies greatly and it is desirable to have a speed reading to correspond to instantaneous readings of other instruments (as, for instance, in a series-motor test), the speed reading may be taken over a short interval, say one of five or ten seconds.

Repeated tests show the accuracy of the apparatus. Readings taken on motors running at constant speed check with one another within 0.005 per cent. The inventor of this device has made arrangements with the Central Scientific Company of Chicago to supply college and other laboratories with this new device.

Motor-Driven Water-Supply System

Where electrical energy is available in rural communities motor-driven pumping outfits are rapidly replacing the water motors or hydraulic rams formerly used. Grit, alkali and sulphur in the water supply usually necessitated that considerable attention be given to these lifts. The presence of these impurities in the water supply is said not to affect the operation of the motor-driven pumping outfit illustrated herewith.



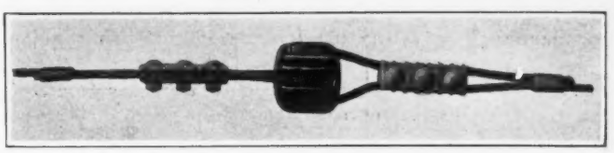
MOTOR-DRIVEN PUMP

This particular type of pump is used for supplying water to closed pressure tanks, the pressure being regulated automatically. The motor is started by an automatic switch which closes the pump motor circuit when the pressure gets low and stops the pump when the pressure reaches a certain predetermined value. This pump, which is a product of the Dayton Pump Company of Dayton, Ohio, is driven through a belt by a small Westinghouse motor taking energy from a lighting circuit.

Porcelain Strain Insulator

A porcelain strain insulator placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is intended for use on 1500-volt direct-current railway work as well as on 2200-volt transmission lines.

It is claimed that the insulators will withstand more strain than any cable used in line construction that will pass through the hole. They are of the interlinking type which makes it impossible for cables to separate even if the insulator should become shattered.



PORCELAIN STRAIN INSULATOR

The smallest size of these insulators has a flash-over voltage on rain test of over 13,000 volts, and the larger size over 20,000 volts. The tensile strength of the larger size insulator is said to be more than 23,000 lb. Its dimensions are 5 in. by 4.5 in. by 4.5 in.

Snap Switch with Round Handle

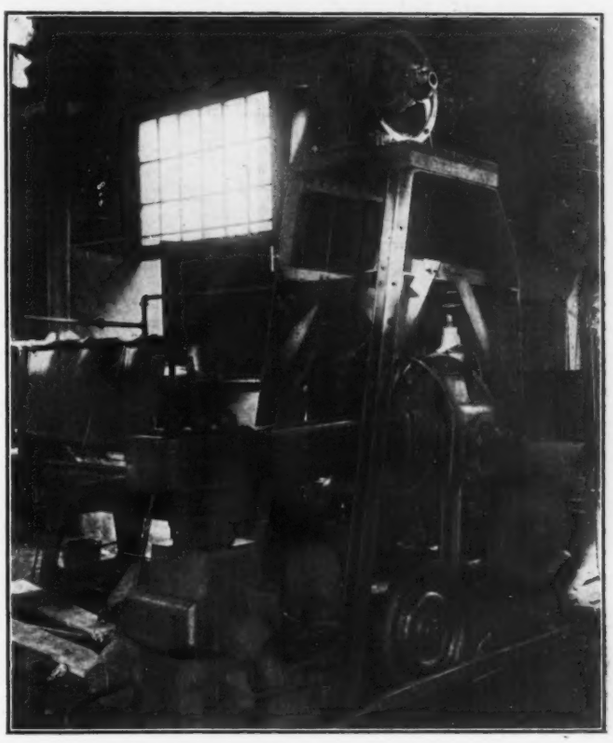
One of the most recent changes in snap-switch design was made by the Trumbull Electric Manufacturing Company, Plainville, Conn., in bringing out a switch with a round handle instead of the ordinary wing handle which has so long been in vogue. The switch, illustrated herewith, does not differ in any of its essentials from the regular line of snap switches handled by this company and is made in all styles or sizes in which the other switches are built. It is stated that this type of switch has been giving thoroughly satisfactory service and that it permits choice of design with no loss of efficiency.

ROUND - HANDLE SNAP SWITCH

Motor Support for Overhead Drive

When a prominent railroad machine shop was recently changed from group drive to individual-motor drive the problem of placing a motor to drive the hammer shown herewith proved to be a perplexing one. Owing to the conditions it was impossible to put up an overhead platform swung from the ceiling, and it was equally impracticable to fasten the motor to the wall. Moving the large hammer was suggested, but it was decided that such action would seriously impair the efficiency of the shop.

The solution of the difficulty was found in erecting a frame of angle-irons and firmly bolting them to the base of the machine on both sides. About 2 ft. above the top of the hammer and 10 ft. from the floor a platform was laid across the angle-iron braces. The motor was then mounted on the platform, giving it a place out of the way and also enabling it to furnish the required overhead drive.



MOTOR SUPPORT FOR OVERHEAD DRIVE

The motor in the accompanying illustration, which was supplied by the Diehl Manufacturing Company, Elizabethport, N. J., is of the 220-volt direct-current type and operates at 650 r.p.m.

Moving Pictures as Targets for Marksmen

A method recently developed for using motion pictures as targets for marksmen differs considerably from the one described briefly in the *Electrical World* of July 26. With the type of apparatus now referred to as soon as the marksman fires his gun the motion of the film is instantaneously arrested and a bright spot appears where the bullet struck the screen. After an interval of a few seconds the spot is extinguished and the picture moves on again ready for the next shot.

The heart of this mechanism is the Kramer-Kapp relay, which has been used abroad in connection with automatic signaling on railway trains. A telephone receiver is placed well up between the firing line and the target. When the shot is fired the sound acts upon the telephone receiver operating the relay, which controls the cinematograph machine by means of a band brake and a magnetic clutch. Thus, at the instant the shot is fired the clutch is released and the brake is applied, thereby bringing the picture immediately to a standstill. In order to keep the film cool at all times and prevent it from catching fire while it is stationary in the machine, a small motor-driven air-compressor is slung under the machine. This compressor maintains a constant blast of cold air on the film and thus keeps it cool.

On the board which carries the relay with its batteries is mounted the dash-pot which controls the spot-extinguishing movement of the screen and the restarting of the machine. The screen itself is formed by two sheets of stout paper, on horizontal rollers, and a third sheet, forming a stay on vertical rollers. The vertical screen is arranged to move a fraction of an inch (roughly the diameter of a shot-hole) after each shot, thus obliterating the hole. The horizontal screen is shifted about once a day. The vertical screen which is selected for regular movement is operated by a ratchet actuated by a solenoid. When the relay is brought into action by the sound of a shot, it closes the circuit of a timing dash-pot, which rises slowly until the upper contacts close the circuit of the screen solenoid. During this interval the shot-hole remains visible, but when the solenoid circuit is closed the hole on the two screens disappears and the moving-picture machine is started again. The screen is illuminated from behind by several flame-arc lamps which are hung so as to be entirely clear of the firing line, thus being secured against being broken by the flying bullets.

Although this apparatus is only now being put on the market, it has been exhaustively tested for the past year. The electrical arrangements, while they appear complex on the surface, operate with certainty. The apparatus has been demonstrated to a number of English military authorities, with excellent effect upon their preliminary skepticism.

This mechanism is said to be protected by patents. The interests of the shooting-moving-picture company in the United States are under the management of Mr. A. H. Woods, of the Eltinge Theater, New York City.

FIG. 2—ARRANGEMENT OF SCREENS

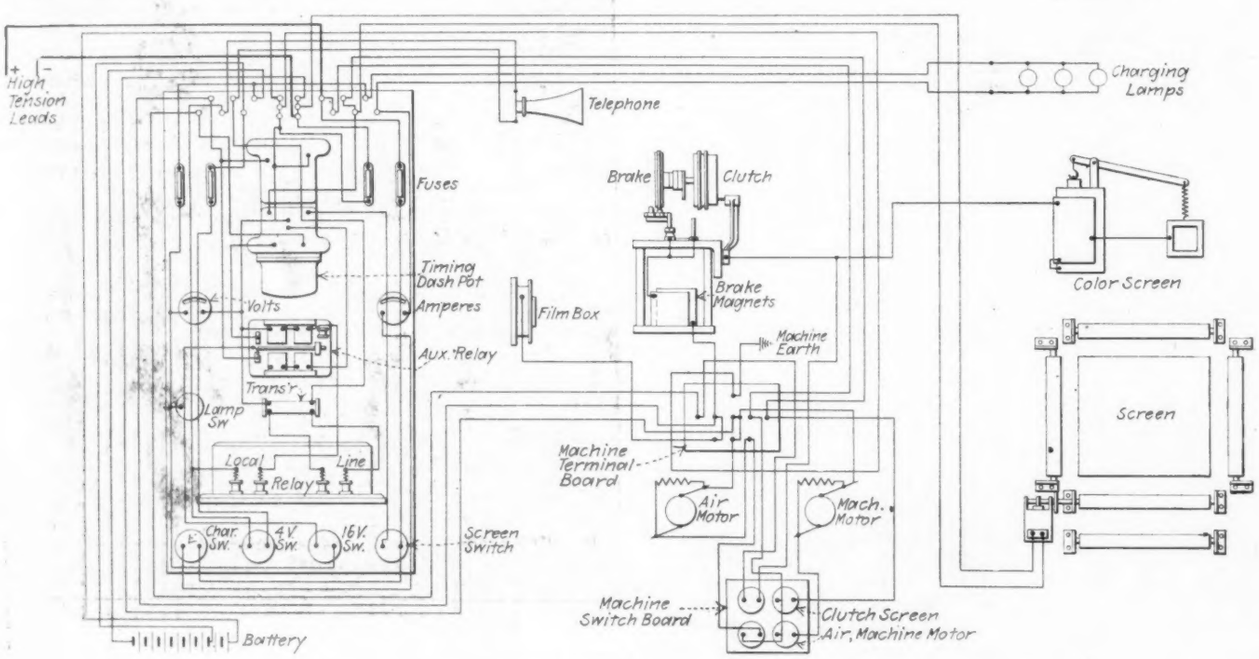


FIG. 1—DIAGRAMMATIC LAYOUT OF CIRCUITS AND APPARATUS

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

The Gee Electric Company, of Wheeling, W. Va., which deals in electrical supplies and machinery and does electrical repair work of various kinds, mainly in connection with mining machinery, has recently added about 5000 sq. ft. of floor space to its establishment and installed new machinery, enabling it to handle a greater volume of business than previously.

New Make of Diesel Engine Introduced.—The American Krupp-Diesel Engine Company was recently incorporated under the Delaware laws to manufacture and sell the Krupp system Diesel engine in this country. This company has, it is understood, the complete American rights to this form of prime mover, which will be marketed in several types and sizes to suit various conditions of service.

Small Maine Hydroelectric Project.—B. W. Page, of Skowhegan, Maine, and others are interested in the construction of a hydroelectric generating station at Jackman, Maine. Working with a 230-ft. head, a penstock 3700 ft. long and 26 in. in diameter has been built and a Smith turbine of 180 hp and 900 r.p.m. installed directly connected to a General Electric alternator of 125-kva, 2300-volt rating. Arrangements for the addition of another similar unit in the future are being made.

Further Sales of York Refrigerating Machines.—An aggregate capacity of 1240 tons in refrigerating machines and accessories has been installed during the past month by the York Manufacturing Company, of York, Pa. The North Atlantic Fisheries, at Port Hawkesbury, N. S., with two 125-ton machines, the Tidewater Oil Company, of New York, with one of 150-ton rating, and the Southern Utilities Company, Fort Myers, Fla., with a 90-ton machine, were among the larger individual purchasers.

Large Electric Riveter Order.—The entire year's production of electric riveters—valued at approximately $1,500,000—of the Eveland Engineering & Manufacturing Company, Philadelphia, Pa., has been sold to the large machinery dealers Manning, Maxwell & Moore, of 85 Liberty Street, New York. The Eveland company is installing a large amount of new machinery to increase its output and will manufacture transformers and electric tempering and hardening machines in addition to the riveters.

Cotton Mills Install Electric Drive Equipment.—The Lancaster Cotton Mills, of Lancaster, S. C., have recently placed contracts for the installation of electric generating and drive equipment at their factory. The Westinghouse Machine Company will supply the turbine and the General Electric Company the motors. Of the latter there will be 270 of 5-hp rating, two of 10-hp, two of 25-hp and one each of 50-hp, 100-hp and 150-hp rating. The installation will include also three 7½-kw transformers and auxiliary switching gear.

Bids for Flame-Arc Lamps.—On July 24 the trustees of the Sanitary District of Chicago opened bids for electrical material to be used in the contract with the city of Chicago for street lighting. Among other things 4000 10-amp long-burning flame-arc lamps will be required. The General Electric Company and the Westinghouse Electric & Manufacturing Company were the only bidders on the lamp contract. They both named the same figure, $31 a lamp. The lowest bidder for underground cable was the General Electric Company.

Trackless-Trolley Line Proposed.—There is a project on foot for running a trackless trolley line between Summit and Bernardsville, N. J., a distance of approximately 25 miles. The application for the necessary franchise is now before the governing boards of the various towns affected, and it is expected that the franchise situation will be settled within the next three or four weeks. The Trackless Trolley Company of America, with headquarters at 30 Church Street, New York City, is back of this movement and will supply the equipment for the service when installed.

Chamber of Commerce to Aid New Industrial Companies.—The members of the Cleveland (Ohio) Chamber of Commerce have authorized the organization of an Industrial Investments Corporation which will investigate and assist financially manufacturing plants locating in that city. The enterprise will be privately controlled, although backed largely by the Chamber of Commerce. It is expected that this plan will draw to Cleveland numerous small manufacturing concerns whose financial requirements, although none the less real to them, are too small individually to interest banks and large capitalists.

Westinghouse Industrial Sales.—A large volume of orders for industrial-drive equipment have been received lately by the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa. All the brick machinery in the plant of the West Virginia Fire Clay Company, at Empire, Ohio, is to be driven by electric motors, as is that of the Keystone Brick Company and the Ferro Brick Company, both of Watsontown, Pa. Other recent purchasers of equipment are the Kosmos Portland Cement Company, Louisville, Ky., the Goodyear Tire & Rubber Company, Akron, Ohio, and the Fiske Rubber Company, Chelsea, Mass.

Equipment for a Kansas Street Railway.—The Manhattan City & Interurban Railway Company, of Manhattan, Kan., has been a large buyer of Westinghouse apparatus during the past month or two. The equipment purchased consists of two 600-volt, three-phase, direct-current, 60-cycle, 1200-r.p.m. self-starting rotary converters, one of 300-kw and one of 200-kw rating; nine 33,000-volt, single-phase, 60-cycle transformers of the oil-insulated, self-cooled type, three of 110-kva, three of 75-kva and three of 37½-kva rating, and two two-panel switchboards. The three smaller transformers will be mounted on a steel tower to form an outdoor-type transformer substation.

Pacific Gas & Electric Company Installing Generating Equipment.—The Pacific Gas & Electric Company is at present engaged in preparing foundations for the installation of an 18,750-kva General Electric vertical ten-stage turbine. Two 100-kw General Electric turbine exciter sets and complete switchboard equipment are included in the order. The turbine is of the condenser-base type, and the condenser will have 20,000 sq. ft. of 1-in. tubes, contained entirely within the base. This is a special design built from the company's own specifications. The condenser will be furnished by the Wheeler Condenser & Manufacturing Company, which will also supply a steam and a motor-driven hot-well pump, a dry-vacuum pump and a free atmospheric exhaust valve in the same order.

Discontent Regarding the Mica Schedule.—Some opposition has developed among manufacturers of electrical apparatus and other users of mica in its various crude and fabricated forms to the rates proposed for this product in the tariff bill now under discussion by Congress. Whether or not there is actually an acute injury to be inflicted on these interests by the present rates, if adopted, is a matter for investigation. It seems as if these rates are an improvement over those of the Payne-Aldrich bill and previous tariff measures since mica was first scheduled and importers (whose interests are to some extent similar, in this case, to those of the manufacturers of electrical equipment), when interviewed following the announcement of the rates on mica proposed by the Senate bill expressed

themselves as satisfied and seemed to feel that they would be slightly benefited by the change from the schedule now in effect. From one point at least the proposed rates seem an improvement over those in previous bills, and that is in the fact that a graduated duty is planned, varying according to the unit values of the different grades of mica imported.

Immense Turbo-Generator Sets Ordered for Philadelphia.—Two big turbo-generator units have been ordered recently by the Philadelphia (Pa.) Electric Company to take care of the rapidly growing demand for electric energy in the district served by it. The larger of these sets, rated at 35,000 kva, represents in one machine a capacity equivalent to that of the combined generating equipment of the company a decade ago. The other unit, although of about the same size and weight as the first—65 ft. long and weighing about 600 tons—is rated at 30,000 kva. The installation of these immense units will necessitate the construction of a new generating station, which will be built adjoining the present main station of the company at Christian Street and the Schuylkill River, Philadelphia. The General Electric Company, Schenectady, N. Y., is to build these two big generating units.

A Sign of Prosperity.—Contrary to prevailing opinions on conditions throughout the country, some manufacturers are almost overwhelmed with business. The Terry Steam Turbine Company, Hartford, Conn., has just started operating on a twenty-three-hour per day basis, the one hour of idleness being from 6 to 7 o'clock in the morning. It is found necessary to do this in order to clear the shop from its present crowded condition, due to congestion of orders during the past few months. June is reported to have been the biggest month ever experienced by the company. Supplementing the note in the July 26 issue of the *Electrical World* regarding the recent purchase of Terry turbines and pumps by the Milwaukee Electric Railway & Light Company, comes information that the latter company has just ordered two more turbo-blower sets of the same make for its plant at Milwaukee, Wis.

Profit-Sharing Percentage Increased.—The Youngstown Sheet & Tube Company, of Youngstown, Ohio, writes as follows concerning its profit-sharing plan: "For three years we have paid our employees 5 per cent annually on their earnings during the year; this year we will pay them 6 per cent, as we had a rather prosperous year. We do not know that we are securing any better work than our neighbors who do not pay this bonus, but we believe that the more intelligent of our employees appreciate it, and we do it because we think it is only fair to them to prosper when the company prospers. It has been a failure in almost every place that it has been tried, probably because the employers expected too much. We do not look for much from it in the way of added efficiency and for that reason are not disappointed. We have had no labor troubles, however, for several years. How much this contributed to that condition we cannot tell. The plan looks good at a long range, but it is unsatisfactory in some respects."

Electrical Equipment of a New York Armory.—The contract for the electrical equipment and wiring in the new armory of the Eighth Regiment, Coast Artillery, to be built at the corner of Kingsbridge Road and Jerome Avenue, New York, will be let shortly. New York Edison energy will be used for the lighting, single-phase, 104-208-volt, 60-cycle current being supplied, while for motor purposes two-phase, 200-volt, 60-cycle current will be furnished. The lighting feeders will be installed as a three-wire system and branches will be put in on the two-wire system. Both branches and feeders on the motor circuits will be installed on the four-wire plan. All branch circuits are to be wired on the loop system. Concealed iron-pipe conduits of "sherarduct" or "galvaduct" or equal will be placed to carry the various circuits and will be embedded in cinder fill. The regular rubber-covered double-braided wire will be used. The main switchboard will be of black marbleized slate and will consist of two motor and five lighting panels, two sections to each panel. The power-station switchboard of the same material will have one panel each for lighting and motor switching. The panel boards used throughout will also be black marbleized slate. Lugs and Dossert connectors will be used on all wiring connections. There are several classes of lighting, including ceiling, floor and side-wall outlets, and illumination for the drill hall, for the cooking-range hoods and for the rifle ranges, and the highest grade receptacles have been specified for each. A call-bell signaling and interior telephone system will be installed on the small-arms range. The transformers will be supplied and installed by the New York Edison Company. The architects for this building are Pilcher & Tachau, 109 Lexington Avenue, New York, and the R. D. Kimball Company, of Boston and New York, is the engineer.

Electrical-Vehicle Growth in New York.—According to figures obtained from the Electric Vehicle Association of America, 124 West Forty-second Street, New York, there were in operation and garaged in the boroughs of Manhattan and the Bronx on July 26 of this year no less than 2150 electric vehicles, as compared with 1750 for July 27, 1912. The largest single users seem to be the brewers, with 322 vehicles in service, while department stores, with 262, are a close second. Of those having in operation more than 100 such cars, express companies, bakers and central stations must be mentioned in the order named. Other branches of business which are particularly large users are wholesale meat markets, jewelers, wholesale dry-goods merchants and the vehicle manufacturers themselves, who by their use of the vehicles achieve the double object of advertising their cars and at the same time securing the advantages of reducing trucking expenses. The list of users of electric vehicles in New York alone includes seventy-six different kinds of businesses, and the number is constantly increasing. This growth is viewed with satisfaction not only by the makers of the cars but also by the storage-battery makers and by the central stations, to both of which it means a steady, dependable source of income.

Western Electric Sales Conference in Chicago.—The second annual conference of Western Electric telephone sales specialists was held in the La Salle Hotel, Chicago, during the week of Aug. 4 and was attended by thirty-one of the company's representatives from different parts of the country. These men are responsible for the sales of the Western Electric telephones to railroads and industrial concerns which operate private exchanges and the convention was primarily for the purpose of discussing sales campaigns. E. A. Hawkins, of Chicago, presided at all the sessions, these being held daily (excepting on Aug. 5, when the delegates visited the Hawthorne plant) and also on the evenings of Aug. 4 and 6. The entire session each day was given up to the reading and discussing of papers on sales conditions and methods and in all about eighty such papers were rendered. These will be assembled in pamphlet form shortly and issued to the company's salesmen as a telephone salesmen's manual. In order to prevent the reading of any one paper from infringing on the time allotted to the next one and thereby interfering with the entire program a novel method was employed. Two miniature incandescent lamps were fixed to the chairman's table, from which the papers were read, and connected to a double plug switch on the table of the secretary, W. D. Lindsey, of New York. Three minutes before the time limit a green lamp was lighted and when the time was up a red lamp was lighted. This scheme proved an effective, dignified means for conveying the message without hurt to the speaker's feelings and without distracting the audience as a buzzer device invariably does.

Commercial Activity of the Republic Railway & Light Company.—Active campaigns for domestic customers are being conducted in all the cities served by this company. The Electric Shop which opened in Youngstown, Ohio, in August of last year has been of great assistance in the sale of electric-heating devices and in the campaign for the wiring of houses that had not contemplated the use of electricity when building. During the first five months of this year the power department closed eighty-one contracts for electric power with a total connected horse-power in motors exceeding 5500. A large number of these customers are now connected and are being served with electric energy. The remainder will be connected as soon as the necessary motor equipment is obtained from the manufacturers. Negotiations are now under way for the electrification of several large industrial plants, and it is expected that contracts will be closed within a short time. In May

the Carbon Limestone Company signed a contract for the complete electrification of its large quarries near Hillsville, Pa. This contract requires a total of 800 hp in electric motors. In February the company began to supply power to the Bessemer Limestone Company, which has one of the largest brick plants in the United States, with a capacity of 1,200,000 bricks per week. This plant requires a total of 750 hp in motors. In addition, the Bessemer company operates large limestone quarries requiring 1200 hp, making a total required of 1950 hp. At present the Republic company is supplying it with 1000 hp in motors. Plans are now being completed for the substitution of electric motors for the steam drive in the remainder of the brick plants and quarries. In addition the Bessemer Limestone Company is preparing to let contracts for the erection of an extension to its brick plant which will double the present capacity. The new plans call for the use of electric motors.

Automobile Accessory Factory for Cambridge, Mass.—Gray & Davis, makers of electric starters and electric-lighting generators and lamps for automobiles, are completing the construction of a new factory for the manufacture of their product on the Charles River Parkway at Cambridge, Mass. The building is six stories in height and measures 380 ft. by 60 ft. It is of reinforced concrete throughout and has a tapestry brick exterior. Seventy per cent of the wall area is taken up by windows. The ground floor contains a service garage, large showroom and various departments, the general offices being on the second floor. The ceilings are built without beams and the company plans to operate all its machinery by electricity. Among the features of the establishment are electric drying ovens, a miniature interior railway transportation system, extensive motor-driven compressed-air system, vacuum cleaners, sanitary drinking fountains and complete lighting installation.

Foreign Field for American-Made Household Appliances.—German manufacturers of electrical appliances are producing numerous articles for household use, but not nearly to the same extent as American concerns. Because of the German import tax, however, their product is able to compete with American-made appliances. The articles of this class which have been most largely exported from this country to Germany are vacuum cleaners and electrical appliances for washing and cleaning. Of the former class only the more expensive varieties are offered for sale, the excellent vacuum cleaners which retail in the United States for $25 or less being unknown. There is a market in Germany for these low-priced cleaners, although it is limited by the fact that comparatively few German houses are wired for electricity. Large portable outfits can be hired at moderate terms and are very generally used. The United States supplied in both 1911 and 1912 a large proportion of the total German imports of electric washing and cleaning machines, but during the latter year the English manufacturers seemed to increase their sales at the expense of the American product. In Norway only a comparatively small number of electric cooking appliances are used at the present time, but they are growing in popularity. American makes have not been introduced, but there is a field for them. It is almost impossible to sell such apparatus from catalogs, as Norwegian dealers will not buy goods which they have not seen. They can probably be sold from samples. While electric irons are not used to the same extent in England as in the United States, there is an increasing demand for them, now supplied chiefly by English manufacturers and by one or two German companies. In Greater London there are some thirty electric companies, supplying energy at voltages ranging from 100 volts to 240 volts. The most popular English and German makes of iron meet this difficulty by arranging for a variation of the operating voltage within the iron itself, and to compete with them any American iron would have to be similarly designed, so as to operate satisfactorily on a wide range of voltages. There is a field for an American iron of low price which will meet these conditions. In the Liverpool district there is a particularly good and increasing demand for this class of appliances, and attempts have been made to introduce the American makes, but these have been so far unsuccessful owing to the unfavorable prices as compared with the English product. Other electrical appliances are in demand to some extent. The use of electricity for heating and cooking in the International Settlement at Shanghai, China, was introduced less than three years ago, and heating and cooking outfits are rented out by the electricity department of the Shanghai Municipal Council at a monthly charge of about 33 cents. Both American and European makes are in use, and the average connected load of such apparatus in 1912 was about 300 kw. Alternating current at 50 cycles and 200 volts is the supply on which these appliances are operated, and the rates of 6 cents per kw-hr. for lighting and 1 2/3 cents per kw-hr. for power uses compare favorably with American rates and make the use of these appliances seem less a luxury.

Barcelona Preferred Stock Issue.—Stockholders of the Barcelona Traction, Light & Power Company, Ltd., have recently authorized the issue of $12,500,000 of 7 per cent non-cumulative preferred stock, of which $10,000,000 worth has been sold to a French syndicate at par, the remainder being held in the treasury for future needs. The proceeds of the sale are to be used for financing further work in and around Barcelona, Spain, where all the electric traction, light and power properties are controlled by the company.

American Water Works & Guarantee Protective Plan.—The committee formed to protect the interests of the common and preferred stockholders of the American Water Works & Guarantee Company has issued a protective agreement to stockholders under which holdings may be deposited with the committee, the Bankers' Trust Company acting as depositary. This committee will have full power to undertake any refinancing or reorganization work deemed expedient in connection with this company or any of its subsidiaries. Copies of any such plan adopted will be sent to the depositors, and any one of them who does not approve of the same may within thirty days after receiving notice withdraw from the agreement by filing with the depositary written notice of his dissent.

Industrial Securities

Security	Capital Stock Listed	DIVIDEND		QUOTATION	
		Per Cent	Period	July 30	Aug. 6
Allis-Chalmers, t.r., 5th pd	$19,800,000	.....	.....	9*	9
Allis-Chal., pf.,t.r.,5th pd.	16,050,000	.....	.....	16½*	16½
Amalgamated Copper	153,887,900	1½	Q	69⅞	70⅞
American Tel. & Tel.	344,471,400	2	Q	128½	128⅝
Electric Storage Battery,c.	16,074,425	1	Q	48½	48
General Electric	101,363,600	2	Q	140*	141
Mackay Cos., c.	41,380,400	1½	Q	77½	89
Mackay Cos., pf.	50,000,000	1	Q	69½*	66
Western Union Tel.	99,747,600	¾	Q	67½*	67
Westinghouse, E. & M., c.	34,496,400	1	Q	63½	63½
Westinghouse, E. & M., pf.	3,998,700	1¾	Q	116*	114

*Last price quoted.

NEW YORK METAL MARKET PRICES

	July 29		Aug. 5	
Copper:	Bid.	Asked.	Bid.	Asked.
Standard, spot*	14.00	.....	14.37½	.....
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard, spot*	65 15 0		67 17 6	
Prime Lake	15.00	to 15.10	15.25	to 15.37½
Electrolytic	14.87½	to 15.00	15.12½	to 15.25
Casting	14.70	to 14.80	14.87½	to 15.00
Copper wire base	....	16.00	16.25	to 16.37½
Lead		4.50		4.50
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f. o. b. smelter		7.25		7.50
Spelter, spot	....	5.60	5.60	5.65
Tin, spot*	40.80	to 41.00	40.80	to 40.87½
Aluminum:				
Prompt delivery	23.00	to 23.50	22.75	to 23.25
Future	21.00	to 22.00	21.00	to 22.00

*OLD METALS

Heavy copper and wire	13.75	13.75
Brass, heavy	8.75	8.75
Brass, light	7.75	7.75
Lead, heavy	4.25	4.40
Zinc, scrap	4.25	4.25

*COPPER EXPORTS

Total tons to Aug. 5 4874

*From daily transactions on the New York Metal Exchange.

Business Notes

The Ohio Electric Car Company is increasing its facilities for manufacturing electric pleasure vehicles in order to double its present output.

Terry Steam Turbine Company.—Hoshall, Simmons & Company, 502 Randolph Building, Memphis, Tenn., have been appointed agents for that city and the territory of Tennessee, Arkansas and the northern part of Mississippi for the Terry Steam Turbine Company, Hartford, Conn.

Tungstolier Works.—The general offices of the Tungstolier Works of the General Electric Company have been moved from Conneaut, Ohio, to the Euclid Building, Cleveland, Ohio, where a salesroom for wholesale business will be maintained.

New Industrial Companies

The H. P. B. Electric Company, of Philadelphia, was incorporated under the laws of Delaware recently, with a capital of $50,000. Lansing W. Powers, Rye, N. Y., chief incorporator.

The Illinois Storage Battery Business of Chicago, of Chicago, Ill., has been chartered with a capital stock of $25,000 to deal in electric batteries. The incorporators are: Paul Larmer, William J. Bryan and Joseph J. Herbert.

The Merrill Electric Manufacturing Company, of Chicago, Ill., has been incorporated with a capital stock of $2,500 by F. W. Merrill, J. L. Arthur and L. A. Nelson. The company proposes to deal in electric machinery and appliances.

The John W. Cronk Company, of Chicago, Ill., has been incorporated with a capital stock of $5,000 by John W. Cronk, E. L. Kramer and George Meyer. The company proposes to deal in electrical supplies and to do an electrical contracting business.

The Leavitt-Jackson Engineering Company, of Brooklyn, N. Y., has been incorporated with a capital stock of $50,000 to manufacture mechanical and engineering instruments. The incorporators are: Frank M. Leavitt, William F. Kip and Daniel D. Jackson, 30 East Forty-second Street, New York, N. Y.

Trade Publications

Insulators.—Forty-three different designs of insulators are illustrated in a folder recently issued by the Brookfield Glass Company, 2 Rector Street, New York. Some of the types are new.

Meters.—The graphic meters of the Esterline Company, Indianapolis, Ind., are illustrated and briefly described in a folder recently issued, No. 272. Many applications for these instruments are shown.

Belt Dressing.—An eight-page booklet has been issued by the Cling-Surface Company, Buffalo, referring to the use of "cling-surface" in railroad shops. Five installations where this material was employed are illustrated.

Hoists.—A large variety of hoists adapted for many duties and some interesting examples of electric hoists are described and effectively illustrated in Bulletin No. 12, recently issued by the Lidgerwood Manufacturing Company, 96 Liberty Street, New York.

High-Tension Fuses.—The Delta-Star Electric Company, Chicago, Ill., is distributing a bulletin descriptive of S & C carbon-tetrachloride fuses for all potentials up to 110,000 volts. Numerous illustrations showing actual installations in commercial operation are given.

Appliance Catalogs.—The Manhattan Electrical Supply Company, of 17 Park Place, New York, has recently issued two publications of interest to the electrical trade. The first is a fan motor booklet of unique size and design and the other is a very complete commercial booklet on vibratory massage, describing the "Premier" vibrator, which is of the company's manufacture.

Generating Sets.—In an eight-page pamphlet recently published by the Engberg's Electrical & Mechanical Works, St. Joseph, Mich., directly connected generating sets of from 2.5-kw to 50-kw rating are illustrated and described.

Electrical Supplies.—A price list and discount sheet covering its lines of electrical supplies and apparatus has recently been put out by the Union Electric Company, of Pittsburgh, Pa. The booklet is well printed and the arrangement of headings excellent.

Electric Vehicles.—An article from the May *Power Wagon* has been reprinted in the form of a leaflet by the General Vehicle Company, Long Island City, N. Y., which contains reports on the work of the three electric trucks of the J. A. Mercier Company and on the two of the A. A. Albrecht Company.

Exhaust Fans.—Bulletin No. 246 of the Sprague Electric Works of General Electric Company refers to motor-driven exhaust-fan outfits, direct and alternating current. Descriptive matter, halftone illustrations and diagrams showing constructive features combine to give considerable information on this type of apparatus.

Insulators.—An illustrated folder has been issued by the Line Material Company, South Milwaukee, Wis., referring to the Kyle line non-drop arc-lamp hangers and insulators. Three other leaflets in the series give brief information with reference to indestructible malleable-iron brackets, pole-line hardware and construction material, and flexible insulator clips.

Engineering Facilities.—In a recently distributed folder entitled "Have You Ever Considered This Method of Cutting Costs?" the Providence Engineering Works, Providence, R. I., set forth their facilities for producing anything in the line of machined parts, where the making of such parts might entail a large investment to a company for buildings and special machinery.

Electrical Specialties.—Catalog 6 of the Machen & Mayer Electrical Manufacturing Company, 21st Street & Fairmount Avenue, Philadelphia, Pa., describes and illustrates the various electrical specialties made by this company, which include, among others, flush switches, flush brass switch plates, flush receptacles, steel wall boxes, iron switch boxes, indicating heater receptacles, remote control stations and panel boards.

Pumps.—Three new bulletins in an attractive binder arranged for future additions have been issued by the Dayton Pump & Manufacturing Company, Dayton, Ohio. No. 15 gives information respecting the Dayton duplex double-acting power pumps and water supply systems. No. 22 refers to deep-well systems. Bulletin No. 30-A has for its subject electric house pump and automatic water lift for bathroom supply.

Telephones.—Pamphlet No. 41, issued by the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., referes to its "Central Energy" telephones, including in addition to the regular line some new and improved instruments. In Pamphlet No. 42 standard local-battery telephones, wall and desk and combination-phone types are shown. The new harmonic party-line telephone is described in this circular.

Adaptiboxes.—The Adapti Manufacturing Company, Winter and Leonard Streets, Cleveland, Ohio, has issued two catalogs, one size 10 in. by 8.5 in., and the other in pocket edition size, both containing the same reading matter. In these are listed "adaptiboxes" in complete units assembled to make the various types most commonly used. The company states that with a selected stock of the complete units and a small assortment of covers and extra lugs the contractor has a stock of fittings that will meet any emergency. The catalogs are fully illustrated.

Stage-Lighting Apparatus.—The latest catalog of the Universal Electric Stage Lighting Company, 240 West Fiftieth Street, New York, contains within its eighty pages descriptions and illustrations of its stage-lighting apparatus and effects. The most up-to-date electrical devices in switchboards, border lamps, stage pockets, dimmers and other stage apparatus are presented in this new publication. It also contains an interesting outline of a modern theater installation in New York, that of the Metropolitan Opera House, which was installed by the Universal company.

Personal Mention

Mr. F. W. Hunter has succeeded Mr. G. W. Russell as superintendent of the light and water department at Sabetha, Kan.

Dr. C. P. Steinmetz, consulting engineer of the General Electric Company, has been nominated for president of the Common Council of Schenectady, N. Y., on the Socialist ticket.

Mr. Philip S. Dodd has resigned as secretary-treasurer of the Society for Electrical Development, and it is understood will leave the electrical industry, in which he is so widely known. Mr. Dodd was formerly director of publicity of the National Electric Lamp Association and prior to that time was business manager of the *Electrical Review.*

Mr. Irwin McNiece, formerly on the erecting engineering staff of the Allis-Chalmers Manufacturing Company, has been transferred to the Salt Lake City office of that company, in the capacity of hydroelectric sales engineer. Mr. McNiece was connected with the old Telluride Power Company (now the Utah Power & Light Company) for a number of years. He was engaged in electric erecting work out of Milwaukee prior to his transfer.

Mr. Norman Read has resigned as electrical engineer of the Denver (Col.) City Tramway to become assistant general manager of the Central Colorado Power Company, in charge of all Colorado properties. The power department of the Denver City Tramway will hereafter be included in the engineering department, reporting to the chief engineer. The position of electrical engineer will remain unfilled for the time being. Mr. J. F. Warner, superintendent of power station, will have charge of the operation and maintenance of the generating station. Mr. W. E. Casey, electrician, will have charge of the maintenance and operation of the substations.

Prof. Vladimir Karapetoff, professor of electrical engineering at Cornell University, started Aug. 6 on an extended trip West for the purpose of visiting the principal hydroelectric developments and high-tension transmission plants. He expects to visit the recent development on the Mississippi River at Keokuk, Ia., and then go to Denver, Salt Lake City, Los Angeles, San Francisco, Portland and Seattle. It is his intention to attend the Pacific convention of the American Institute of Electrical Engineers in Vancouver, B. C., Sept. 9-13, and to return East by way of the Canadian Pacific Railroad. He will be back in Ithaca about Sept. 20, in time for the beginning of the school term.

Mr. Frank N. Boyer, for several years assistant district manager of the Chicago office of the General Electric Company, has been appointed district manager in St. Louis for the same company, succeeding the late George D. Rosenthal. The new manager of the St. Louis office has been active in electric business affairs of the Middle West for a number of years. In earlier life he was for some time superintendent of the Edison Light & Power Company, of Reading, Pa. In 1889 he became connected with the Chicago office of the old Edison General Electric Company. When the Edison and Thomson-Houston companies were consolidated to form the General Electric Company in 1892 Mr. Boyer was made assistant manager of the supply department in the Chicago office. Three years later he was made Chicago manager of the department, a position which he held for more than thirteen years. In May, 1908, Mr. Boyer was promoted to be assistant manager of the Chicago office, succeeding in that position the late James W. Johnson, who had just been made manager of the office. Mr. Boyer has an exceptionally wide acquaintance among electrical men.

FRANK N. BOYER

Dr. Harold Pender, who has been appointed director of the research division of the department of electrical engineering at the Massachusetts Institute of Technology, was born at Tarboro, N. C., Jan. 13, 1879. He received his early education in Baltimore and prepared for college at the McDonough School. He was graduated at Johns Hopkins with the degree of A.B. in 1898 and received the degree of Ph. D. from the same institution in 1901, being at the time assistant in the physical laboratory of the university. The next year he spent at the McDonough School as instructor, and during the following year he was instructor in physics at Syracuse University. In January, 1903, Dr. Pender went to the Sorbonne, Paris, on special invitation of the late M. Poincaré, under a grant from the Carnegie Institution, to repeat there certain experiments on the magnetic effect of a moving electrostatic charge. His previous series of experiments, extending over two years, which confirmed Maxwell's theory and an earlier experiment made by Prof. Henry A. Rowland, had been questioned by a French scientist, V. Cremieu, who had been unable to detect such an effect. The Paris investigation which was undertaken by Pender and Cremieu together proved beyond reasonable doubt that a moving charge does produce a magnetic field. In May, 1903, Dr. Pender entered the apprenticeship course of the Westinghouse Electric & Manufacturing Company and was appointed to a regular position on the engineering staff in the fall, being given charge of the testing of silicon steel for electrical purposes. In 1904-05 he was in the electrical engineering department of the New York Central, his work being largely the planning of the distribution system of the New York Terminal. He next became associated with Dr. Cary T. Hutchinson, and was at the time secretary and assistant to the chief engineer of the McCall Ferry Power Company. The work upon which he was engaged from 1905 to 1909 included a report to the International Railway Company of Buffalo on the use of water-power to charge batteries in connection with its steam plant; a report to the city of New York on the cost of complete lighting from a municipal plant; the electrification of the Cascade tunnel of the Great Northern Railway, together with various economic and hydraulic problems for the McCall Ferry Power Company, and investigations of the effect of methods of heat treatment on the magnetic and electric properties of silicon steel. Since 1909 Dr. Pender has been connected with the Massachusetts Institute of Technology, until 1912 as professor of electrical engineering and now as director of the research division of the department of electrical engineering. The technical articles from the pen of Dr. Pender include a score or more of important contributions in French and in English to the leading technical journals. He is the author of "Principles of Electrical Engineering" and editor of "The American Electrical Engineer's Handbook."

Obituary

A. S. Michener, controller of the Puget Sound Traction, Light & Power Company, of Seattle, Wash., was drowned Sunday while on a fishing trip up the Homahoma River near Seattle. Together with Messrs. J. P. Dabney, A. L. Kempster, A. W. Leonard, C. C. James and Mr. Best, of the Puget Sound Traction, Light & Power Company, Mr. Michener left Saturday on the launch of Mr. J. Sodenberg, a prominent business man of Seattle, whose guests they were. Arriving at their destination, the party started up stream on foot, and the supposition is that Mr. Michener while fishing alone slipped. His dead body was discovered half an hour later. Algernon Stanton Michener was born in Washington, D. C., in 1869 and was a son of the late Captain John E. Michener. After graduating in law from Georgetown University he entered the American Ordinance Company, leaving there later to join the staff of the Stone & Webster organization. At the time of his death he was vice-president and controller of the Puget Sound Traction, Light & Power Company, having left Boston for Seattle in 1912. He is survived by a widow, sister and brother. Interment will be made at Washington on Aug. 9.

Construction

New England

WESTBOROUGH, MASS.—Bids will be received by the trustees of the Westborough State Hospital, at the office of H. O. Spalding, M. D., superinendent Westborough State Hospital, Westborough, until Aug. 15 for the erection of a concrete power house. Plans and specifications may be obtained at the hospital or at the office of the Richard D. Kimball Co., 6 Beacon Street, Boston, Mass.

PAWTUCKET, R. I.—A special meeting of the Blackstone Valley Gas & El. Co., of Pawtucket and Woonsocket, has been called for Aug. 12 to authorize an increase in the capital stock of the company by $500,000, to provide additional funds for additions and improvements, including an addition to the central generating station of 12,000 hp and the construction of a new coal-gas plant at Pawtucket.

Middle Atlantic

CHATEAUGAY, N. Y.—The Chasm Pwr. Co. expects to purchase soon one 100-kva transformer. W. T. Thayer is manager.

CORTLAND, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 12 for the construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Cortland, N. Y. Drawings and specifications may be obtained at the above office or from the custodian at Cortland. O. Wenderoth is supervising architect.

JAMAICA, N. Y.—The New York & Queens El. Lt. & Pwr. Co. has purchased a site on Van Wyck Avenue, just north of the new Long Island Railroad terminal, on which it proposes to erect a new substation, executive offices and headquarfters for the construction force of the company in the Jamaica district. Energy for the substation will be supplied from the Long Island City and Astoria generating stations.

MECHANICSVILLE, N. Y.—The Mechanicsville El. Lt. & Gas Co. expects to purchase within the next 30 days one 150-hp boiler, one feedwater heater (150 hp), motor to drive pump and No 6 and No. 8 weatherproof pipe. Edward Farrow is president and manager.

NEW YORK, N. Y.—The Public Service Commission, First District, has executed a contract with the E. E. Smith Contracting Co., 101 Park Avenue, New York, for the construction of the section of the Broadway (Manhattan) subway lying between Union Square and Twenty-sixth Street for $2,056,702. The plans call for a four-track underground railroad with one-half of the express station at Union Square and a local station at Twenty-third Street and Madison Square.

PLATTSBURG, N. Y.—The Plattsburg Gas & El. Co., it is reported, has completed arrangements for extensive alterations and improvements to its system, work on which has already begun. The company is rebuilding the lines from its power house at Indian Rapids to Plattsburg, and when completed the transmission lines will be extended to Morrisonville to furnish electrical service in that village.

SYRACUSE, N. Y.—The Oswego River Pwr. Trans. Co., of Syracuse, has applied to the Public Service Commission for permission to construct a distributing system in the town of Schroeppel and erect a transmission line across that town to a connection with the lines of the Mexico El. Co. in the town of Palmero; also to begin construction of distributing system in the villages of Cato and Meridian to furnish energy for lamps and motors in those places. This construction involves the extension of the company's lines from the hamlet of Fairdale, through the towns of Hannibal, Ira and Cato, through the settlement of Hannibal Center and Ira Hill, to the villages of Cato and Meridian.

TROY, N. Y.—The contract for the construction of the new telephone building of the New York Telephone Co., to be erected at Fourth and State Streets, Troy, at a cost of $500,000, has been awarded to the Charles P. Boland Co., of Troy.

DAUPHIN, PA.—The residents of Dauphin are preparing a petition asking the county court for authority to raise the money necessary to install an electric-lighting system. The service will be furnished by the Harrisburg Lt. & Pwr. Co., which was recently granted a franchise by the Borough Council. The streets are now lighted by oil lamps.

WILLIAMSBURG, PA.—The Penn Central Lt. & Pwr. Co., of Altoona, is building a new plant at Williamsburg. The initial equipment will include a 4000-kw Westinghouse turbine and Edgemoor boilers. The ultimate generating capacity of the plant will be 15,000 kw. Contracts for equipment have been placed. Day & Zimmerman, of Philadelphia, are engineers.

CAMDEN, N. J.—The City Council has rejected an ordinance appropriating $540,000 for a municipal electric-light plant. A resolution was adopted by the Council providing that the question should be brought before the voters at the next election.

EGG HARBOR, N. J.—The dam at Park Lake gave away on Aug. 1, undermining the concrete foundations to the electric-light plant and sawmill. The electric-light plant, it is said, was badly damaged.

SOUTH RIVER, N. J.—Bids will be received by the Borough Council and Board of Public Works, South River, until Aug. 11 for the construction of an addition to the electric power plant, including the installation of gas-producer engine, generator, switchboard, coal pit and coal conveyor. C. S. Partridge is superintendent of public works.

WASHINGTON, D. C.—Bids will be received at the Engineer Depot, United States Army, Washington Barracks, D. C., until Aug. 22, for furnishing five direct-current switchboards, etc. Further information may be obtained upon application to Major W. J. Barden.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 28, for furnishing and installing lighting fixtures in the new building for the Bureau of Engraving and Printing, Washington, in accordance with plans and specifications, copies of which may be obtained at the above office. O. Wenderoth is supervising architect.

WASHINGTON, D. C.—Bids will be received at the Government Printing Office, Washington, D. C., until Aug. 25 for furnishing and installing in that office certain boilers, stokers, feed-water heaters, piping and flues, foundations, coal and ash-handling machinery, smokestack, turbine and generator switchboard and tunnel between the Government Printing Office and the new post office building. Detailed specifications and proposal giving complete information, etc., may be obtained by addressing Cornelius Ford, public printer.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 19, for furnishing at the various navy yards and naval stations supplies as follows: Norfolk, Va., Schedule 5711—one motor-driven spiral disk grinder, complete; Boston, Mass., Schedule 5701—restranding and insulating cables; Philadelphia, Pa., Schedule 5709—miscellaneous truck and storage battery, complete, etc.; Brooklyn, N. Y., Schedule 5701—500 ft. paper-insulated, lead-sheathed telephone cable, 3500 ft. rubber-insulated, lead-sheathed duplex cable, 700 ft. paper-insulated lead-sheathed three-conductor cable; East and West, Schedule 5659—miscellaneous electric fixtures, miscellaneous globes for electric fixtures and prismatic reflectors; Mare Island, Cal., Schedule 5664—two 50-kw turbo-generator sets complete, two 100-kw turbo-generator sets complete with spare parts; Schedule 5665—three portable current transformers, three double-voltage, single-phase indicating wattmeters, one high-sensitivity galvanometer, etc. Bids will also be received at the same place until Aug. 26, as follows: Mare Island, Cal., Schedule 5712—9600 ft. miscellaneous paper-insulated and lead-sheathed electrical cable, Naval Engineering Experiment Station, Annapolis, Md., Schedule 5679—furnishing and installing one Diesel engine, one direct-current oil-engine-driven exciter unit and one alternating-current generator. Bids will also be received at the same place until Sept. 2, as follows: Brooklyn, N. Y., Schedule 5698—for miscellaneous transmitting and receiving radio sets; Mare Island, Cal., Schedule 5700—one motor-driven emery grinder, one motor-driven surface planer grinder, one motor-driven grindstone, with trough complete, one motor-driven boring and mortising machine, one motor-driven core-box machine, one 24-in. motor-driven vertical swivel-turret boring and turning mill, one vertical 30-in. motor-driven boring and turning mill, one motor-driven hydraulic test pump, one 34-in. motor-driven band saw, one motor-driven, universal bench saw and one motor-driven scroll saw. T. J. Cowie is paymaster general, U. S. N.

North Central

BAY CITY, MICH.—The lighting committee is contemplating the installation of a new street-lighting system, to cost approximately $27,000. The present plans provide for 152 standards, carrying inverted 6.6-amp magnetite lamps. Park cable will be used. F. H. Mohr is chairman of lighting committee, and William H. Fitzhugh superintendent of the municipal electric-light department.

CASS CITY, MICH.—At a special election held recently the proposition to issue $11,000 for improvements to the municipal electric-light plant and water-works system was carried. It is proposed to erect a new power house on another site, the present plant to be moved to the new power house, additional machinery put in and a new street-lighting system (tungsten lamps) installed.

HOUGHTON, MICH.—The Houghton County Trac. Co. is planning to remodel its substation at Laurium.

MASON, MICH.—Within the next 30 days the managers of the municipal electric light plant expect to purchase a generator and engine, exciter, switchboard and instruments, transformers, lightning arresters, meters, etc., and within the next three months two boilers. George N. Cummings is superintendent.

CLEVELAND, OHIO.—Bids will be received at the office of W. H. Kirby, secretary to the director of public service, No. 204 City Hall, Cleveland, until Aug. 14, for electric-light poles for the Municipal Electric Light Department, in accordance with plans and specifications which may be obtained in the office of the engineer of construction, 419 City Hall. W. J. Springborn is director of public service.

CLEVELAND, OHIO.—Bids will be received at the office of W. H. Kirby, secretary to the director of public service, No. 204 City Hall, Cleveland, Ohio, until Aug. 12, for transformers for the Brooklyn and Collinwood stations of the municipal electric light department, in accordance with plans and specifications which may be obtained in the office of the engineer of construction, Room 419, City Hall. W. J. Springborn is director of public service.

MARTINS FERRY, OHIO.—Improvements are being made to the distribution lines of the municipal electric-light plant and Westinghouse meters are being installed for the flat-rate consumers. J. W. Tush is superintendent.

OAK HARBOR, OHIO.—The Town Council has decided to submit the proposition of bonding the town for the installation of a municipal electric-light plant at a special election to be held soon. The Council has rejected the proposition of the Ohio Northwestern Ry. & Pwr. Co. for street lighting.

PIQUA, OHIO.—The Dayton Lt. & Pwr. Co. (which owns the Piqua electric plant), it is reported, has closed a contract with the Western Ohio Ry. Co., of Lima, for energy to operate the local system. A transmission line will be erected from Lockingham to Piqua, a distance of 6 miles. The Western Ohio Ry. Co. will also furnish energy to operate the cars of the Dayton & Troy El. Ry. Co. and the Dayton, Covington & Piqua Trac. Co. Under the terms of the contract power is to be delivered at the Lockingham substation by Oct. 1. O. H. Hutchings, of Dayton, is general superintendent of the Dayton Lt. & Pwr. Co.

SANDUSKY, OHIO.—At an election held July 30 the proposition to issue $200,000 for the installation of a municipal electric-light plant was defeated.

TOLEDO, OHIO.—Bids will be received by the Board of County Commissioners of Lucas County, Court House, Toledo, until Aug. 28, for furnishing materials required and construction of underground steam and water connections and electric service wires at the power plant of the Lucas County Infirmary, in accordance with plans and specifications prepared by David L. Stine, architect, Toledo, which are on file in the office of the county auditor and at the office of the architect. Charles J. Sanzenbacher is auditor.

TROY, OHIO.—The city of Troy expects to rebuild its power house next year, combining the electric power plant and water-works system, and go into new fields for water-works, using wells. L. A. Pool is superintendent.

CLAY, KY.—The Clay Lt. & Ice Co. expects to purchase new equipment and machinery as follows: One about 30-kw, single-phase, 60-cycle, 2300-volt, revolving-field, belt-driven generator, one automatic steam engine (about 50 hp), switchboard for above generator and leather drive belt. The company would consider second-hand machinery, but it must be in first-class condition. C. R. Clark is secretary and manager.

HARDINGSBURG, KY.—Within the next 60 days the Hardinsburg El. Lt. & Pwr. Co. expects to erect an electric light and power plant and to purchase within the next 30 days one 30-kw or 40-kw, 220-250-volt direct-current generator and 9-in. belt, switchboard and material for wiring for inside and outdoors, and will also need one power pump for boiler-feed. Engine and boiler have been purchased. Within the next six months the company will also purchase from 800 to 1000 incandescent lamps.

HENDERSON, KY.—Bids will be received at the office of L. P. Hite, superintendent of the municipal electric-light plant, until Aug. 16 for one 400-hp water-tube boiler with chain-grate stoker; also for one 225-ft. (by 11 ft. inside diameter) self-supporting unlined steel smokestack. An alternative proposal will be accepted on radial brick smokestack of same dimensions. Specifications may be obtained on application to the above office.

HOPKINSVILLE, KY.—The Kentucky Pub. Ser. Co., of Hopkinsville, has closed a contract with Captain S. G. Ragsdale, who owns the lighting franchises in Pembroke and Trenton, to furnish energy from the Hopkinsville plant to operate the systems in the two towns. It is also proposed to furnish electricity to residents along the line, which will be 20 miles long. The Kentucky Pub. Ser. Co., it is said, contemplates the construction of a new power house in Hopkinsville in the near future.

LEBANON, KY.—The Lebanon Lt., Ice & Pwr. Co. expects to purchase within the next 12 months a coal and ash-handling system. J. A. Kelly is treasurer.

LIVERMORE, KY.—The Smith-Cooperage Co., of Livermore, is negotiating with the residents of the town of Island, 3 miles distant, to extend its electrical service to that place. If an agreement is reached equipment will be required for the entire line.

LOUISVILLE, KY.—The Board of Park Commissioners is contemplating the installation of a new lighting system along the borders of the Southern and Eastern Parkways. The Louisville Gas & El. Co. has been asked to submit estimates for furnishing the service.

BOURBON, IND.—A new tungsten street-lighting system has recently been installed here by the Union Wtr., Lt. & Pwr. Co. E. Kessler, superintendent.

FRANKFORT, IND.—The Board of Electric Light Commissioners expects to purchase within the next 12 months one 500-hp boiler, a 1000-kw turbine and 120 meters. H. B. Wickham is secretary.

LEBANON, IND.—The Interstate Pub. Ser. Co., successor to the Citizens' El. Lt. & Pwr. Co. of Lebanon, expects to rebuild its transmission lines within the next 12 months. The company has just installed one 300-kw General Electric turbine and one switchboard panel. F. H. Miller is local manager.

SHERIDAN, IND.—The Sheridan Wtr., Lt. & Ht. Co. has nearly completed the installation of a complete new electric-light plant and water-works. The equipment consists of one 100-kw and one 75-kw generating unit and 300-hp boiler and new General Electric switchboard. A day service was established July 1, 1913. C. E. Layton is secretary and treasurer.

HILLSBORO, ILL.—Arrangements are being made by the Peabody Coal Co. to install electrical equipment in the Kortkamp mine, near Hillsboro, for operating hauling and lifting apparatus.

LINCOLN, ILL.—A movement has been started by the business men to install ornamental street lamps on Broadway between Kickapoo and Chicago Streets.

OTTAWA, ILL. — The Northern Illinois Lt. & Trac. Co., of Ottawa, has increased its capital stock from $250,000 to $750,000.

PANA, ILL.—The Central Illinois Pub. Ser. Co., of Mattoon, has submitted a proposition to the City Council offering to furnish energy for lamps and motors to the city and for street-lighting. The company agrees to furnish arc lamps at $60 each per year, electricity for domestic purposes at 8 cents per kw-hr., for industrial purposes at 4 cents per kw-hr. and for the ornamental street lamps at 4 cents per kw-hr.

STERLING, ILL.—The installation of a new electric elevator in the new city hospital (to cost $2,000) is under consideration.

WATSEKA, ILL.—The Central Utilities Co., of Watseka, is reported to have purchased a site in Watseka upon which it will erect a new power plant.

ANTIGO, WIS.—The Antigo El. Co. has been granted authority by the Wisconsin Railroad Commission to issue $10,000 in capital stock to provide funds for extensions and additional equipment.

JANESVILLE, WIS.—The Janesville El. Co. expects to purchase a 300-kw to 400-kw, three-phase, 60-cycle, 2300-volt, 600 r.p.m. generator with switchboard panel. The company would prefer a good second-hand generator. P. H. Korst is manager.

KIEL, WIS.—Bids will be received by Fred Duecke, village clerk, until Aug. 20 for the construction of an electric-light system for the village of Kiel. Plans and specifications are on file in the office of the village clerk.

MADISON, WIS.—The Peninsula Pwr. Co., of Madison, has received authority from the Wisconsin Railroad Commission to issue capital stock to the amount of $400,000, the proceeds to be used for the purchase of additional equipment for its hydroelectric plant and transmission line in the counties of Florence, Wis., and Dickinson, Mich., and for the retirement of outstanding bonds, etc.

MEDFORD, WIS.—The Medford Lt. & Htg. Co. contemplates improving its distribution system by putting in larger wire. William Ungrodt is superintendent.

MENOMONIE, WIS.—Bids will be received by the trustees of the State Board of Industrial Education for the State of Wisconsin, at the Stout Institute, Menomonie, Wis., until Aug. 18, for general construction, heating, ventilating, plumbing and electric wiring for the new trades building and additions to present boiler house and fuel rooms and present heating plant, etc., to be erected at Menomonie, in connection with the Stout Institute. Copies of plans and specifications may be obtained from John D. Chubb, architect, 822 Chicago Opera House, Chicago, Ill., for which a deposit of $25 will be required to be refunded upon return of same. Complete sets of drawings are on file at the Stout Institute, Menomonie, also at the office of the architect, Chicago, Ill.; the Builders' Exchange, Milwaukee, and the Builders' Exchange, Minneapolis, Minn.

EAST GRAND FORKS, MINN.—The managers of the municipal electric-light plant are building a new substation and rebuilding the distribution system of the municipal electric-light plant. Material and supplies have already been purchased. Charles E. Fiers is superintendent.

ROCHESTER, MINN.—Contracts have been awarded by the city of Rochester for material for an incandescent cluster-lamp street-lighting system, at a cost of about $3,700. The plans provide for 59 lamp standards, carrying one 60-watt and four 40-watt lamps, maintained by underground cable. The city will install the system. H. E. Swanson is superintendent of the municipal electric-light plant.

CHARLES CITY, IA.—The capital stock of the Charles City Lt. & Ht. Co. has been increased from $75,000 to $250,000.

CLINTON, IA.—Bids will be received by the county auditor of Clinton County, Clinton, until Aug. 13, for the construction of a power house and steam-heating plant in the County Home. The cost is estimated at about $7,000.

FONDA, IA.—The city of Fonda has voted to issue $15,000 in bonds for the installation of a municipal electric-light system. The Northern Iowa Pwr. Co., of Humboldt, will furnish energy for same. Arrangements have been made whereby the company will erect the transmission line from Humboldt to Pomeroy and thence to Fonda, furnishing poles, lines, transformers and everything complete to furnish a 24-hour service.

MASON CITY, IA.—The People's Gas & El. Co., of Mason City, expects to erect within the next three months an addition to its power house and to install one 2000-kw turbine and two 500-hp boilers and to install within the next six months one 1000-gal. deep-well pump. M. Anderson is manager.

POMEROY, IA.—At an election held July 12 bonds to the amount of $15,000 were voted for the erection of a transmission line (14 miles long) to connect with the lines of the Northern Iowa Pwr. Co., of Humboldt, which will furnish energy to operate same. The company will also build the lines and distributing system in Pomeroy under contract

with the town. No engineer has yet been engaged. S. H. McClure is city clerk.

SPENCER, IA.—Bids will be received until Aug. 15 by Miss Etta M. Smith, city clerk, Spencer, for the installation of a 12-in. by 16-in. Corliss engine in the municipal power house, in accordance with plans and specifications, copies of which may be obtained from the city clerk or from K. C. Gaynor, of Sioux City, consulting engineer.

SPIRIT LAKE, IA.—The electric plant of the Spirit Lake El. Co. was recently destroyed by fire, causing a loss of about $15,000. At present the town of Spirit Lake and the resorts at Orleans, Arnold's Park and Templar Park are without electrical service. The plant, it is understood, will be rebuilt at once.

TIPTON, IA.—The Tipton Lt. & Htg. Co. has changed its plant from direct current to alternating current. A new substation has been erected which will be equipped with three 50-kva transformers, lightning arrester, oil switches, switchboard, etc. All material has been purchased.

DEXTER, MO.—The proposition to issue $58,000 in bonds for the installation of an electric-lighting plant and sewers will soon be submitted to the voters.

JOPLIN, MO.—At an election held recently the proposition to issue $75,000 in bonds for extensions and improvements to the municipal electric-light plant was defeated. This is the third time since April 22 that a proposition to enlarge the plant has been defeated.

LAMAR, MO.—Within the next six months the city of Lamar expects to purchase heating appliances, vacuum cleaners, washing machines and motors. Charles B. Hall is superintendent of the municipal electric-light plant.

OZARK, MO.—The Ozark Pwr. & Wtr. Co. has applied to the State Utility Commission for authority to issue $6,000,000 in bonds, the proceeds of $2,000,000 to be used for the construction of the White River dam and the remainder to be utilized in enlarging the dam and general improvements.

FORT PIERRE, S. D.—The Fort Pierre Power Co. expects to purchase within the next two months material for erection of electric transmission line across the Missouri River. Copper-clad steel wire and towers will be used. The company would like to receive catalogs and prices from manufacturers of towers.

GARRETSON, S. D.—The town of Garretson expects to purchase within the next three months one 20-hp oil engine, one 18-kw, three-wire, 250-volt direct-current generator, one blue Vermont marble switchboard panel and necessary instruments to match switchboard now installed.

GRAND ISLAND, NEB.—Extensive improvements are being made to the municipal electric-light plant, including construction of new power house and the installation of a 500-kva Allis-Chalmers turbo-generator with all condensing equipment, at a cost of about $20,000. An electrolier lighting system for the business section, consisting of five-lamp clusters and using steel-taped cable instead of conduits, costing about $13,000, is being installed. J. H. Miller is water and light commissioner.

PLATTSMOUTH, NEB.—The Nebraska Ltg. Co., of Plattsmouth, is reported to have decided to rebuild its entire plant. Energy for operating the local system while improvements are being made will be supplied from Red Oak, Ia., for which transmission lines are now being erected. Arthur Huntington, of Chicago, is engineer in charge of the work.

SALEM, NEB.—An election has been called for Aug. 25 to vote on the proposition to issue $4,953 in bonds for the installation of a municipal electric-light plant. A preliminary estimate has been submitted by the Alamo Engine & Supply Co., of Omaha, placing the cost of the plant at $6,000.

ABILENE, KAN.—The Riverside Lt. & Pwr. Co., of Abilene, is reported to be negotiating with the city of Herington to secure a lease of the municipal electric-light and power plant. If the deal is carried through, energy will be transmitted from the power plant at the River to Herington, a distance of 20 miles.

COTTONWOOD FALLS, KAN.—The Home Lt. & Pwr. Co. is installing a 50-hp internal-combustion engine for auxiliary power for ice plant now being installed. W. W. Austin is manager.

MANHATTAN, KAN.—The Manhattan City & Interurban Ry. Co. contemplates the construction of a new power house soon in Manhattan.

MULVANE, KAN.—The Mulvane Ice & Cold Storage Co. expects to erect within the next three months a new building, 45 ft. by 30 ft., for engine room for power plant, and to purchase within the next two months one 15-kva, three-phase, 60-cycle, 2300-volt generator, one 80-hp and one 20-hp oil engine. O. A. Climerts is manager.

SABETHA, KAN.—Within the next 30 days the managers of the municipal electric-light plant expect to purchase one 200-kva Westinghouse-Parsons three-phase, 60-cycle, 2300-volt turbine, one boiler-feed pump and one switchboard panel complete with instruments for above generator. F. W. Hunter is general superintendent.

Southern States

BENSON, N. C.—At an election held recently the proposition to issue $25,000 in bonds for the installation of a municipal electric-light plant was carried.

BLACK MOUNTAIN, N. C.—The Black Mountain Tel. Corpn. will install an electric-light plant in connection with the Dickey-Campbell Co. The proposed plant will be located about 1¼ miles from the town. The equipment will include one 75-kva General Electric generator, switchboard, etc.; 120 poles and 4500 lb. No. 18 and 6-wire will be used for the distribution system. Work has already begun on the plant. F. B. Braid has charge of the work.

TARBORO, N. C.—The City Council has authorized improvements to be made to the municipal electric-light plant, to cost about $5,500. Contracts for machinery have already been placed. E. P. Meredith is superintendent.

WILSON, N. C.—The city of Wilson, it is reported, has engaged Gilbert White, of Charlotte, to prepare plans and superintend the construction of the proposed new lighting system. The cost of the work is estimated at $100,000.

ROCK HILL, S. C.—Within the next 30 days the water and light commissioners expect to purchase three 100-kva, 11,000-2200-volt transformers for the municipal electric-light plant. J. G. Barnwell is superintendent.

YAZOO CITY, MISS.—The Public Service Commission expects to purchase within the next three months one motor-generator set for the municipal electric-light plant. J. S. Butler is superintendent.

ALEXANDRIA, LA.—The managers of the municipal electric-light plant and water-works system expect to install a 1000-kw Allis-Chalmers high-pressure, three-phase, 60-cycle, 2300-volt turbine and to purchase within the next few months a surface condenser with vacuum pumps and vertical submerged-type centrifugal cold-water injection and pump with vertical motor.

ARCADIA, LA.—The North Louisiana Lt. & Pwr. Co., of Arcadia, expects to erect within the next six months a 6600-volt transmission line to Gibslands, a distance of 8 miles, and to purchase within the next five months one 90-kw, three-phase, 60-cycle, 2300-volt generator, one 125-hp engine and one 54-in. by 16-ft. horizontal tube boiler, switchboard and protective devices, and within the next six months transformers and poles; also within the next 12 months to purchase fans and heating apparatus. The company purchased the electric plant in Arcadia about 90 days ago and is incorporated with a capital stock of $10,000. J. B. Herring is president; B. Davis, vice-president, and J. T. Reeves, secretary and treasurer.

HAMMOND, LA.—The Hammond Ice, Lt. & Bottling Co. expects to purchase within the next six months a 150-kw or 200-kw, 2300-volt generator directly connected to turbine or oil engine and switchboard panel for same. James Jumonville is manager.

OPELOUSAS, LA.—The managers of the municipal electric-light plant expect to purchase within the next three months one 150-hp oil engine, one 100-kva alternator and generator switchboard panel. A. C. Jones is superintendent.

RAYNE, LA.—The managers of the municipal electric-light plant expects to purchase within the next six months an internal-combustion engine of about 150 hp, with three-phase, 2300-volt alternating-current generator. Plans have not yet been prepared for the new plant and it is not yet known exactly what will be required. E. J. Bertrand is superintendent.

MUSKOGEE, OKLA.—The War Department has given its approval of the project to construct a dam and hydroelectric plant in the Grand River between Muskogee and Fort Gibson. The proposed plant will be built by the Muskogee Wtr. Pwr. Co., which has contracted with Chicago capitalists to build the plant at a cost of about $1,000,000. The plans call for the development of 10,000 hp.

RALSTON, OKLA.—The managers of the municipal electric-light plant expect to erect an addition to the municipal power house and install an 80-hp engine and a 100-hp boiler to replace the gas engine now in use, and also to purchase within the next two weeks the equipment mentioned above; also to purchase within the next three months a duplex pump with capacity of 500 gal. per minute, and within the next two months material for distribution system, including meters, wires, etc. F. E. Bryant is commissioner.

DENISON, TEX.—The City Council is considering the question of installing an electrically operated pump in the water-works pumping station.

GRAPEVINE, TEX.—The property of the Grapevine Lt. & Ice Co. has been purchased by J. W. Day, of Fort Worth.

MADISONVILLE, TEX.—The Madisonville Lt. & Pwr. Co., recently organized, proposes to construct an electric light and power plant. A. A. Allen, A. E. Page and F. E. White are incorporators.

ORANGE, TEX.—The Orange Ice, Lt. & Wtr. Co. has just completed the installation of a 15-ton Vogt exhaust ice-making machine in connection with its electric plant, using the exhaust for the ice plant.

SAN ANTONIO, TEX.—The Mountain Townsite Co., 225 Bedell Building, San Antonio, is reported to be contemplating the development of 1500 acres at Mount Alamo, in Kendall County. The plans provide for installation of water works, electric-light plant and sewer system. Bids for construction of same will be opened Sept. 15. E. T. Hall is engineer in charge. I. M. Putnam is president of the company.

TEXAS CITY, TEX.—The Texas City Electric Lt. & Wtr. Co. is now installing a 200-kw, 2200-volt synchronous motor directly connected to one 50-kw, 250-volt direct-current generator and on opposite end of motor one 150-kw, 250-volt direct-current generator, all manufactured by the Westinghouse Company. This installation includes new panel-equipment, operating on three-wire, 250-500 direct current, for industrial uses at 250 volts and for street-car service at 500 volts; also one 25-kw alternating-current and direct-current exciter set.

Pacific States

BREMERTON, WASH.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 16, for furnishing air compressors, condensers, filters, pipings, meters, etc., at the navy yard, Puget Sound, Wash. The cost is estimated at $40,000. Plans and specifications may be obtained on application to the bureau or to the commandant of the navy yard named. H. R. Stanford is chief of bureau.

DAVENPORT, WASH.—The County Commissioners of Lincoln County have granted the Washington Wtr. Pwr. Co. of Spokane, a franchise to erect and maintain transmission lines in this county. The company will erect a line from Davenport to Crescent, Wilbur and Almira at once.

EVERETT, WASH.—The City Council has granted the Northern Pacific Trac. Co. a franchise to construct and operate an electric railway in Everett.

TACOMA, WASH.—Within the next four weeks the Tacoma Ry. & Pwr. Co. expects to erect a 13,000-volt, three-phase transmission line to the powder works at Du Pont, a distance of 14 miles, with 300-kva transformer installation at DuPont. K. C. Schluss is superintendent of power and equipment.

VANCOUVER, WASH.—The Independent El. Co., of Portland, Ore., has petitioned the County Commissioners for a franchise to furnish lighting and motor service and also for permission to erect transmission lines from the Woodland Bridge to La Center and thence to the north line of the city limits of Vancouver.

CONDON, ORE.—The Condon El. Co. expects to purchase a few incandescent lamps within the next six months.

ARCATA, CAL.—The Humboldt Cooperage Co., of Arcata, it is reported, is planning to install a new power plant, including the erection of a new concrete power house, 70 ft. by 40 ft., and a new fuel bin. At present there are 20 motors in use in the factory and 30 more will be installed. The old steam engine will be taken out and two more boilers added.

MARTINEZ, CAL.—The Pacific Gas & El. Co. has awarded a contract to H. R. Ingram, of Martinez, for the construction of a reinforced concrete and steel electric substation at the Associated Oil Plant in Avon. The station will be equipped with five transformers. Energy for the refinery will be supplied from this section.

MONROVIA, CAL.—The City Council is considering the question of extending the ornamental street-lighting system to White Oak Avenue on Myrtle Avenue, thus adding several more blocks to the system.

ST. MARIE'S, IDAHO.—Application has been made to the Public Service Commission by H. S. Simmonds, of St. Marie's, for permission to install a power plant to be operated in conjunction with the plant of the St. Marie's Lumber Co. If granted a franchise, electricity will be supplied in this city and vicinity.

RED MOUNTAIN, COL.—The Western Colorado Pwr. Co. is erecting an outdoor 17,000-volt switching station to accommodate 22 sets of disconnecting air-brake switches controlling circuits to mines and small towns within a radius of 7 miles and at altitude varying from 6000 ft. to 13,000 ft.

ST. ELMO, COL.—The Tin Cup Gold Mining Co., of Denver, has been granted a permit by the Secretary of Agriculture to construct a hydroelectric power plant on Chalk Creek in the Leadville national forest near St. Elmo. Energy will be transmitted across the Continental Divide and will be used to operate a gold dredge at Tin Cup. The initial installation will develop about 300 hp.

Canada

WINNIPEG, MAN.—The city of Winnipeg expects to erect 77 miles of three-phase, 110,000-volt, two-circuit steel-tower transmission line and to purchase three 4000-kw, three-phase, 60-cycle, 6600-volt generators, various switch gears for 110,000, 6600 and 2200-volt circuit, within the next 12 months; also to purchase various quantities of material for distribution and lighting systems (most of which is now let on tender) and 2000 flatirons. E. V. Caton is engineer.

GRAND FALLS, N. B.—The corporation of Grand Falls will soon call for tenders for substation equipment and pole-line supplies for a distribution system to furnish electricity for lamps and motors in Grand Falls. Energy to operate the system will be obtained from the Maine & New Brunswick Pwr. Co. An electric motor-driven pumping plant is at present being installed here by the Canadian Allis-Chalmers Co., Ltd.

HALIFAX, N. S.—The foundry department of the Nova Scotia Car Co. was recently destroyed by fire. This department will be rebuilt at once and equipped throughout with electrically operated machinery.

BRIGHT, ONT.—The question of securing electricity from the Hydro-Electric Power Commission of Ontario is being considered.

FORT WILLIAM, ONT.—The Kaministiquia Pwr. Co., of Fort William, it is reported, is contemplating making further improvements to its plant at Kakabeka Falls, 19 miles north of Fort William. The proposed work contemplates a development of 15,000,000 hp, at a cost of about $1,000,000. W. A. Black is managing director and R. S. Kelsch consulting engineer, both of Montreal.

KINGSTON, ONT.—The city of Kingston is contemplating placing overhead wires underground. Tenders will soon be called in connection with placing certain sections underground.

MOUNT FOREST, ONT.—The Water and Light Commissioners expect to purchase a water pump of about 40 hp and also within the next three months to purchase wire and wiring supplies. John Morris is superintendent.

NEW TORONTO, ONT.—At an election held recently the by-law to secure electrical service from the Hydro-Electric Power Commission was approved by the ratepayers. The by-law involves an expenditure of about $7,000, which will cover the cost of distribution lines from the substation and for street-lighting purposes.

ORILLIA, ONT.—Within the next two years the Orillia Water, Light & Power Commission expects to erect a new reinforced-concrete hydroelectric power house complete (operated under a 47-ft. head), equipped with three units of 5000-kw rating, and to purchase two 1500-kva, three-phase, 60-cycle, 2200-volt generators, two exciters, complete switchboard for 5000 kva, 2200-22,000-volts, three sets electrolytic arresters, oil switches, etc., four 750-kva transformers for 2200-22,000 volts, single-phase, 60 cycles. W. K. Greenwood is engineer.

TORONTO, ONT.—The villages of Drumbo, Princeton, Plattsville and Ayr have recently voted in favor of by-laws authorizing the municipalities to enter into contracts with the Hydro-Electric Power Commission of Ontario for hydroelectric power.

TORONTO, ONT.—The Hydro-Electric Power Commission of Ontario has decided to enlarge the power station at Niagara Falls, Ont., and to double the transmission lines between London and Dundas. The towers are already erected and work will begin at once on stringing the wire to supply the western portion of Ontario with Niagara power. The cost of the work is estimated at $300,000.

WESTON, ONT.—The Weston Water Power and Light Commission is contemplating extensions to the hydroelectric system throughout the town of Etobicoke in response to a petition of the ratepayers in that section of the county, who are anxious to secure electrical service from the Hydro-Electric Power Commission of Ontario. It is proposed to erect transmission lines to connect Weston with Richview, Burgess' Corners and Thistletown. The cost of the proposed extension is estimated at about $13,000.

HULL, QUE.—The ratepayers recently approved a by-law authorizing the expenditure of $21,000 for a new generator to take care of 100 supplementary arc lamps for street illumination.

MONTREAL, QUE.—The Montreal Board of Commissioners has decided to accept the tender of the Canadian Allis-Chalmers Co., Ltd., Montreal, for furnishing an electrically driven pump of 6,000,000-gal. capacity for the high-level reservoir. The pump will be directly connected to a 455-hp single motor unit, the type not yet decided upon.

QUEBEC, QUE.—The Canadian government, it is reported, is contemplating the construction of a large dry-dock (1150 ft. long, 137 ft. wide and 40 ft. deep), to be located at St. Joseph de Levis, opposite Quebec. The present plans provide for the installation of a large electric generating plant, to be equipped with three direct-current units (550 volts), one 1500-kw, one 750-kw and the third 300-kw, driven by steam turbine or by triple expansion reciprocating engines.

WESTMOUNT, QUE.—The Council has awarded a contract to R. I. Smith & Co., Montreal, for the construction of a conduit on Western Avenue. The cost of the work is estimated at $25,000. The city is now installing 50 inverted magnetite-arc lamps on Western Avenue, which will replace the present bracket arc lamps.

REGINA, SASK.—The city of Regina expects to erect a building for a 12,000-kw steam station, and complete switchboard equipment, consisting of approximately six generator panels, two exciter panels and 16 feeder panels. E. W. Bull is manager.

New Incorporations

DOVER, DEL.—The Ingison Hydro Electric Pwr. Co. has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $1,000,000. The incorporators are: J. W. Ingison, M. H. Powers and C. Bicker, of Bowbells, N. D.

ATLANTA, GA.—The Middle Georgia Tel. Co. has been incorporated with a capital stock of $25,000 by J. A. Faucett, H. M. Fleetwood, of Macon; J. P. Peacock, of Cochran, and others. The company proposes to construct a telephone system through five counties and ten cities.

NIAGARA FALLS, N. Y.—The Canadian-American Pwr. Corpn. has been incorporated with a capital stock of $4,000,000 to develop and distribute electricity in Erie, Niagara, Orleans, Monroe, Chautauqua and Cattaraugus Counties. The directors are: E. G. Connette, of Buffalo; S. Reading Betron, Marshall J. Dodge and Francis T. Homer, of New York, and Rodman E. Griscom, of Haverford, Pa.

BLACKLICK, PA.—The Blacklick Lt., Ht. & Pwr. Co. has been granted a charter with a capital stock of $5,000 to operate in Blacklick Township. The incorporators are: C. V. Bergh, A. G. Lanners, M. B. Courtright and W. L. Scott, of Philadelphia. The main office of the company will be located in Philadelphia.

DOLAND, S. D.—The Doland El. Co. has been incorporated with a capital stock of $10,000 by D. P. Fargo, William Eells and others.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JULY 29, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,068,404. ALTERNATING-CURRENT MOTOR; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Feb. 4, 1910. Operates motor as commutator motor for running and as an induction generator with rotor circuit closed for braking; has means for varying number of poles of the inducing winding to control the braking speed.

1,068,410. PROCESS OF AND APPARATUS FOR COATING ELECTRIC CONDUCTORS; L. W. Chubb, Wilkinsburg, Pa. App. filed June 25, 1907. Produces insulating film on wire by moving wire progressively through a bath and causing simultaneous flow of current through the wire and through the bath.

1,068,411. METHOD OF AND APPARATUS FOR COATING WIRES; L. W. Chubb, Wilkinsburg, Pa. App. filed Jan. 26, 1910. Passes aluminum wire progressively through electrolyte contained in a series of tanks connected by tubes through which the wire passes.

1,068,412. APPARATUS FOR TREATING WIRES AND CABLES; L. W. Chubb, Wilkinsburg, and H. R. Edgecomb, Edgewood Park, Pa. App. filed Jan. 26, 1910. Wire is passed through slots in end walls of a series of tanks, and the liquid escaping through the slots is caught in pans, pumped back and used again.

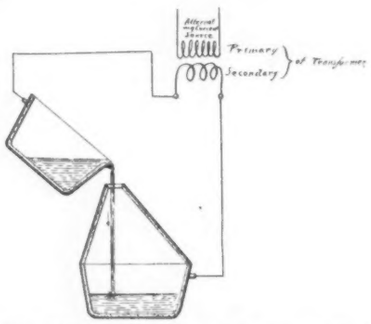
1,068,413. METHOD OF AND APPARATUS FOR COATING WIRES AND CABLES; L. W. Chubb, Wilkinsburg, Pa. App. filed June 25, 1907. An alternating current is induced in the conductor as it passes through the bath.

1,068,439. MANUFACTURE OF ELECTRICAL ACCUMULATORS; P. Marino, London, England. App. filed Aug. 3, 1912. Coats aluminum grid with an acid-resisting and electrically conductive composition.

1,068,440. FIRE-ALARM SYSTEM; J. J. McCarthy, Newton, Mass. App. filed Oct. 28, 1912. Current in an ordinary working circuit, such as bell, lighting, or even a telephone circuit, is made use of to sound an alarm in case of fire.

1,068,453. MAGNETIC SEPARATOR; L. G. Rowand, East Orange, N. J. App. filed Jan. 27, 1903. Uses armature rotating freely in a magnetic field as a separating element.

1,068,469. FIRE ALARM; J. H. Walsh, South Framingham, Mass. App. filed June 4, 1912. Fusible block held in place between two spring-contact arms by a pin extending into the block from one of said arms.



1,068,643—Method of Heating Material by Electricity.

1,068,473. ELECTRIC WELDING MACHINE; W. C. Winfield and A. C. Taylor, Warren, Ohio. App. filed Oct. 16, 1911. For making accurate butt welds; has slidable work holding clamps operated by toggle.

1,068,494. GENERATOR, CONVERTER AND ALTERNATING-CURRENT MOTOR; V. A. Flynn, Blackheath, England. App. filed May 8, 1907. Stator has an exciting winding, with two windings displaced from each other and means for short-circuiting the two last-named windings, and the rotor has slip-rings, a commuted winding and an additional winding connected to the commuted winding and to a slip-ring.

1,068,521. AUTOMATIC SWITCH FOR TELEPHONE SYSTEMS; G. E. Mueller, La Grange, Ill. App. filed July 27, 1910. Movable wiper is moved in a primary direction to select a group of contacts and thereafter in a secondary direction to select a contact in the group.

1,068,531. ELECTRIC MOTOR; H. A. Rhodes, Denver, Col. App. filed Sept. 13, 1909. Field structure in the form of a plurality of ironclad solenoids and armature has segments of same length as the solenoids.

1,068,558. ELECTRIC FURNACES; J. Bally, Grenoble, France. App. filed July 5, 1912. Central inductor having polar pieces so arranged that the axes thereof extend radially from the axis of the furnace.

1,068,568. APPARATUS FOR CLEANING ARTICLES; E. L. Couch, Hartford, Conn. App. filed Jan. 31, 1913. A movable belt of electrolytically active material carries the articles into and out from chambers containing chemicals or gases which will react with the electrolytically active material.

1,068,588. OIL SWITCH; E. H. Jacobs, Schenectady, N. Y. App. filed July 19, 1910. Metallic reinforcing lining embedded in the insulating walls and bottom of the containing vessel; fluid put under pressure by the arc is confined in the metallic part of the vessel and is directed against the arc to extinguish it.

1,068,614. AUTOMATIC BLOCK SYSTEM; W. H. Watson, Los Angeles, Cal. App. filed March 24, 1908. Semaphores are set so near the track as to be engaged by a control member projecting from the train.

1,068,615. ELECTRIC FURNACE AND PROCESS OF OPERATING THE SAME; E. Weintraub, Lynn, Mass. App. filed Oct. 5, 1912. The vaporizable electrode is a flowing stream within arcing range of the material to be melted.

1,068,640. SECONDARY OR STORAGE BATTERY; B. Ford, Philadelphia, Pa. App. filed Dec. 29, 1911. An insulating shelf receives and insulates the falling sediment.

1,068,641. SECONDARY OR STORAGE BATTERY; B. Ford, Philadelphia, Pa. App. filed Dec. 29, 1911. Inactive grid with buttons of rolled, ribbed lead tape inserted in openings in the grid.

1,068,643. METHOD OF HEATING MATERIAL BY ELECTRICITY; W. S. Franklin, South Bethlehem, Pa. App. filed March 2, 1906. Heated material is poured from one receptacle into another, the refractory linings of the receptacles being in circuit.

1,068,658. ELECTRICAL HEATING DEVICE; G. A. Hughes, Chicago, Ill. App. filed July 11, 1912. Resistance conductor laid in grooves in refractory plate and looped through holes connecting alternate pairs of grooves.

1,068,681. IGNITION APPARATUS; H. Lyon. Gloucester City, N. J. App. filed June 5, 1911. Hot-wire igniter located in closed ignition chamber receiving gas direct from burner outlet.

1,068,702. SYSTEM OF ELECTRICAL CONTROL; W. Robbins and A. H. Zimmerman, St. Louis, Mo. App. filed Dec. 11, 1911. For vehicles; to prevent overspeeding, sudden reversal of motor, to disconnect energy before applying brakes, to throw controller to "off" position when brakes are applied, and to return controller to its original position if brakes were not applied long enough for controller to have reached its "off" position.

1,068,706. ELECTRIC COOKING APPARATUS; L. D. Smith, Detroit, Mich. App. filed Feb. 12, 1912. Has removable top and bottom and an intermediate permanently secured radiator.

1,068,707. METHOD OF HEATING CARBON AND APPARATUS THEREFOR; W. A. Smith, Niagara Falls, N. Y. App. filed May 23, 1912. Subjects carbon to heat developed by induced electric currents.

1,068,716. APPARATUS FOR PRODUCING HOLLOW QUARTZ BODIES; A. Voelker, Beuel, and N. Meurer, Cologne, Germany. App. filed Sept. 14, 1911. Quartz body fused around vertical heating core and is supported by the core, the inflating medium being introduced through the hollow perforated core.

1,068,740. ELECTRIC-HEATING APPARATUS; O. A. Colby, Wilkinsburg, Pa. App. filed Dec. 5, 1910. Handle to the heater unit contains the terminals and serves to secure the heater detachably in the vessel.

1,068,757. SECONDARY MEMBER FOR INDUCTION MOTORS; G. H. Garcelon, Wilkinsburg, Pa. App. filed Oct. 31, 1910. Squirrel-cage type core slots inclined without twisting the straps.

1,068,759. ELECTRIC MOTOR FOR TRANSMITTING ANGULAR MOVEMENTS; R. Giradelli, Rome, Italy. App. filed March 7, 1912. Transmitting and receiving apparatus, the latter having an auxiliary motor.

1,068,763. ELECTRIC-HEATING DEVICE; W. S. Hadaway, Jr., East Orange, N. J. App. filed July 24, 1908. Metal cylinder with ribbon of resistance material insulated therefrom and bound in place by a wire wrapping.

1,068,774. ELECTROGRAPHIC DISPLAY APPARATUS AND METHOD; M. R. Hutchison, Bronxville, N. Y. App. filed Oct. 30, 1905. Hand-controlled contact device is moved over body containing an electrolyte to produce writings, etc.

1,068,812. SMOOTHING OR LAUNDRY IRON; A. Niola, Newark, N. J. App. filed Sept. 1, 1911. Special form of heating coil and a switch which cuts out current when iron is tilted on its heel.

1,068,869. SELECTIVE TELEGRAPH SYSTEM; C. M. Edwards, Galveston, Texas. App. filed Sept. 6, 1912. Selecting means is cut out of path of current to minimize resistance.

1,068,871. COOLING DEVICE FOR TELEPHONE TRANSMITTERS FOR STRONG CURRENT; C. E. Egner, Stockholm, and J. G. Holmstrom, Saltsjostorangen, Sweden. App. filed March 26, 1910. Uses cooling medium such as paraffin.

1,068,907. RESISTOR; P. Kraeuter, Wilkinsburg, and S. M. Kintner, Pittsburgh, Pa. App. filed Dec. 10, 1910. Strap with continuous edges and zigzag arranged apertures.

1,068,928. WARNING APPARATUS FOR THE PROTECTION OF VALUABLE OBJECTS; A. L. Pucel, Sceaux, France. App. filed Feb. 12, 1913. Gives warning in case of attempt to remove or damage an object such as a picture, strong-box, etc.

1,068,929. BATTERY PLATE; G. H. Rabenalt, Buffalo, N. Y. App. filed March 26, 1912. Increases capacity of pasted storage-battery plate by forcing a fabric die into the paste while soft and removing the die after the paste has sufficiently set to cause the grooves to remain.

1,068,949. TELEPHONE DISINFECTANT ATTACHMENT; J. Tichy, Chicago, Ill. App. filed Dec. 9, 1912. Web of disinfectant paper is fed across mouth of transmitter.

1,068,972. REGISTER FOR TELEPHONE CALLS; H. S. Brewington, Baltimore, Md. App. filed Dec. 19, 1911. Attached to telephone instrument and can be operated from central station only when the subscriber has adjusted the mechanism to permit such registration.

1,069,014. TROLLEY POLE AND WHEEL; J. F. Ireland, Pennville, Ind. App. filed Dec. 10, 1909. Endless chain, supported on two wheels, carries clamps which engage the trolley wire.

1,069,027. TRACK RELAY FOR ELECTRIC SIGNAL SYSTEMS; J. J. Rudick, Newton, Mass. App. filed Aug. 17, 1912. Relay is in normally closed circuit and is maintained inoperative until a car passes onto the insulated-rail section.

1,069,051. STRAIN INSULATOR; F. G. Woodlock, St. Louis, Mo. App. filed Sept. 23, 1912. Insulating body with outwardly tapering threaded sleeves embedded therein and a transverse tool-receiving sleeve also embedded in said body between the sleeves.

1,069,060. MOTOR CONTROL; E. L. Gale, Sr., Yonkers, N. Y. App. filed Nov. 8, 1910. Combination of reversing switches and stop magnet for elevators.

1,069,061. MOTOR-CONTROLLING SYSTEM; E. L. Gale, Sr., Yonkers, N. Y. App. filed Nov. 18, 1911. For elevators; alternating-current motor with generator as a dynamic brake therefor.

1,069,089. HOUSED TRACK CONTACT FOR RAILWAY SIGNALING SYSTEMS; B. F. Wooding, Denver, Col. App. filed May 23, 1911. Spring housings for the track contacts yield to the train hanger.